

# **Contesting crop sciences in the emerging agrarian social structure in India: A social constructivist understanding of knowledge production in agriculture**

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## **Chapter-I**

### **Crop sciences in the emerging agrarian social context in India**

#### **Introduction**

Agriculture, one of the oldest practices of human civilization, epitomizes man's relationship with nature. It encapsulates a set of technologies which manifest man's understanding of nature. Cultivation, as explained by Aristotle, 'is a practice that helps nature to produce more perfectly or abundantly things which she could produce herself' (Mitcam, 1978: 243). It was believed that 'in farming, although man performs all kinds of preparatory tasks, such as clearing, plowing and sowing, nature itself has to do the rest. Once his preparatory tasks are done, man can only sit down and wait. It is the inner growing power of living nature which performs the work' (ibid: 243). However, over the years human beings evolved a set of practices which help them in manipulating the physiological features of crop growth thus limiting the role of nature. These practices have co-evolved on the basis of cumulative knowledge and the knowledge thus accrued was shared between the members of the community.

Until the advent of science of crop production, farming progressed by imitation. Improvements in practices of crop cultivation were isolated random accidental improvisations which spread through word of mouth and established as practices. The occurrence of these accidental inventions and innovations in agriculture were sporadic and spatial and communities worked hard in the adaptation and adoption. These improvisations added to the cumulative knowledge in agriculture and were passed on from generation to generation. The knowledge of cultivation practices has been transformed with the scientific understanding of crop physiology, soil, and nature's role in food production. Modern science, through its principles, evolved certain standard practices which proved to be advantageous than the practices hitherto followed by farmers. Thus, over a period, community knowledge has been replaced by scientific knowledge and science began to guide crop production. The examples of hybrids of yester years and genetic engineering of today showcase the scientific advancement in agriculture.

At the same time, scientific knowledge in agriculture evolved into a discipline of its own handling the tasks of production and problems of crop cultivation. The science of agriculture fast became a tool of state in serving the purpose of meeting the food needs of

population and in contributing to nation's economy. The role of science in agriculture began to increase with the attention of nation-states to achieve food self sufficiency and derive advantages in the evolving world market. Heralding on modernist programme, public institutions in India, during the green revolution phase, pushed western ideology and methodology in crop science research for a long time. In the process of working for the goals of the nation, the state institutions not only delivered what was needed but also grew in strength exemplifying the potential of state-science interface for society.

The critical appraisal of science of crop production began to arise in the post-liberalized regime in India. The agrarian crisis witnessed in India in the post 1990s is largely attributed to the withdrawal of state from research and extension, opening up of private partnerships in crop science research, policy provisions for private investments in plant breeding with adequate market safeguards for such investments. Also the public research in crop sciences was severely affected by the apathetic attitude of the state towards agriculture which started to believe that agriculture was a 'private good'. Private investments in crop science research came into those crops which offer remunerative returns and focused on those categories of farmers who can afford to invest. The capitalist tendencies in agriculture research intensified the maladies of agriculture inherent within and effects were more prominent on the vulnerable sections of farmers than before.

This resulted in serious and critical appraisals of policy shifts and the aftermaths in agriculture across globe, including India. Locating the arguments in the small and marginal farmer context the critiques of research and development in crop sciences in the post liberalization era began to offer alternative paradigms. Non-essentialist, sustainable and economically viable alternatives to the mainstream explanations of crop production started to emerge. Non-pesticidal management, biological and genetic diversity, sustainable practices, biosafety are some of the key notions that gained ground in the discourse on alternatives in crop science. More critical of biosafety of genetically modified seeds, external chemical intensive agriculture, capital intensive crop production practices, the advocates of alternate practices focused attention on building science of crop production that is farmer friendly rather than market friendly. Serious questioning of the assumptions of mainstream crop science like soil, plant and pathogens led to alternative paradigms. For example, 'system of rice intensification' (SRI) as an approach of rice cultivation emerged in the precincts of civil

society organizations and offers alternative to the green revolution based seed-irrigation-fertilizer intensive cultivation (Prasad, 2006).

### **Politics of agricultural knowledge**

Modern science evolved certain standard practices which are privileged over farmers' practices. The ideological basis of modern science justified the best management practices suggested by the scientific community over farmers' conventional cumulative wisdom. Thus the diffusion of innovation literature categorizes farmers on an adoption-innovation continuum from innovators to laggards. The politics of knowledge took other form in which nation-states tried to use crop sciences to strive for food self sufficiency. In 'scientization of politics' political problems are seen as technical ones and modern science is seen as a means to fix political problems (Habermas 1971). The ideological basis of modern agricultural science - eradication of hunger with the help of science - however, eventually transformed science as a means to pursue political and economic ends.

The lineage of technological rationality translating into political rationality is long but 'we need to ask why a technical reason was found to be compelling, when it could have been challenged, and what counts as technical superiority in specific circumstances' (Wajcman 2002). Scientists working in agricultural research institutes recognize the role of external factors influencing the research agenda. These factors are not just located within the body of scientific knowledge. Political and economic interests influence agricultural research across countries. Jennings (1988) observes that international agricultural research used 'science as a vehicle for politics'. Studies of science and technology policy presuppose a pivotal role for sovereign nation states in generation and advancement of new knowledge. However, 'even though transnational states continue to claim the same formal political sovereignty over decisions related to 'national' economy and growth as enjoyed by the classic nation states, their actual autonomy in policy-making and national regulation has been severely eroded by the structures of the global economy' (Nanda 1995). In this critical examination, the role of international agricultural research institutions comes under scanner. The international agricultural research institutes which claim to have the stated goal of 'providing sufficient food to feed the world's hungry populations' found to be political in nature for they set the agenda for research in less developed countries (Jennings 1988).

## **Emerging context of agriculture in India**

Agriculture in India is undergoing radical changes in the post liberalization era owing to multiple factors. With the launching of economic reforms based on neo-liberal agenda crop cultivation became knowledge intensive, commercialized, competitive and globalized. The change is also witnessed in the form of rapid decline of role of state in agriculture extension and other services to the farming community.

Structurally today's agriculture is dominated by small and marginal farmers operating small holdings. All India Report on the 'Number and Area of Operational Holdings' released by the Agriculture Census Division, Department of Agriculture, Co-Operation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India, 2018 suggests that the total number of operational holdings in the country has increased from 138 million in 2010-11 to 146 million 2015-16 i.e. an increase of 5.33% and the average size of operational holding has declined to 1.08 ha. in 2015-16 as compared to 1.15 in 2010-11.

There is a constant rise in marginal and small holdings and decline in the large holding since 1970 (see Table 1 and 2). Also the report on the Agriculture Census of 2015-16 reveals that there is a rise in the number of women farmers, scheduled caste farmers and scheduled tribe farmers in the country. Sociologically speaking, these farmers' disposition towards agricultural technologies, agricultural information, and most importantly towards state is different from that of upper caste, large farmers (referred to as progressive farmers) who were the blue-eyed boys of green revolution period. These sections of farmers present characteristics which cannot be explained in terms of classical diffusion of innovations approach. As these small and marginal farmers belong to lower strata in the society, their social, cultural and economic capital is poor when compared to large farmers of the upper social strata. Vasavi (2012) maintains that these sections of farmers are caught by the 'web of risks' such as low risk taking ability, lack of required technical knowledge, lack of access to working capital and marketing networks, low investment, low productivity, weak market orientation, in the present day agriculture.

**Table 1: Number of operational holdings as per different Agriculture Censuses**

	1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06	2010-11	2015-16
Marginal	14599	17509	19735	22042	24894	28121	29814	32026	35908	37960
Small	19282	20905	23169	25708	28827	30722	32139	33101	35244	36435
Semi-Medium	29999	32428	34645	36666	38375	38953	38193	37898	37705	37168
Medium	48234	49628	48543	47144	44752	41398	38217	36583	33828	31367
Large	50064	42873	37705	33002	28659	24160	21072	18715	16907	14212

**Table 2: Area operated by operational holdings as per different Agriculture Censuses**

	1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06	2010-11	2015-16
Marginal	14599	17509	19735	22042	24894	28121	29814	32026	35908	37960
Small	19282	20905	23169	25708	28827	30722	32139	33101	35244	36435
Semi-Medium	29999	32428	34645	36666	38375	38953	38193	37898	37705	37168
Medium	48234	49628	48543	47144	44752	41398	38217	36583	33828	31367
Large	50064	42873	37705	33002	28659	24160	21072	18715	16907	14212

Indian agriculture is on the threshold of second green revolution luring all sections of farmers irrespective of size of land holdings and irrigation sources. Also the extension of green revolution technology to less endowed, resource poor regions exposes these farmers to the risks of technology, governance, and market. In the absence of state at the time of such expansion into these fragile regions, and to the less privileged farmers could spell great damage to the social fabric. Beyond the economic gains (in terms of increased productivity of crops) and near sufficiency in food grain production the issue of farm security is assuming critical importance. It is argued that that the outcomes from the institutions of crop science in India are increasingly becoming irrelevant in the small and marginal farmer contexts. It is alleged that these scientific outcomes are biased towards large, upper caste farmers and more significantly oriented to benefit market forces rather than small and marginal farmers. Thus, in the hope of making a livelihood, we see small and marginal farmers moving from sustainable practices to commercial, capital intensive cultivation.

## **Statement of the problem**

Critical examination of scientific practices in agricultural sciences and the institutional priorities involved in agricultural research has been attempted by social scientists before. However, this attempt was largely from a ‘technological deterministic’ perspective. These attempts were essentially aimed at understanding the implications of the scientific advances in agriculture on society. Attempts at problematizing the scientific practices, methodologies, priorities, assumptions of crop sciences have been missing.

Social science discourse on agriculture predominantly revolves around social, structural and economic aspects of agrarian relations suspending the critical scrutiny of science of agriculture assuming crop science to be esoteric, equitable, democratic and beyond social scientists’ gaze. On the other hand scientific community engaged in crop science research view crop production as ‘asocial’ treating it in isolation from agency at the crop production level. Historical understanding of science of crop production suggests that the practice of cultivation predates science. Edgar Zilsel (2000), providing an account of how science was born, suggests, for instance, ‘the social barrier between the two components of the scientific method broke down and the methods of the superior craftsmen were adopted by academically trained scholars, real science was born’. Practice of crop production evolved over centuries through certain principles and practices based on empirical testing and standardization. There is a dearth of research on these presumably separate worlds of social and natural sciences to present a coherent perspective on the contemporary agriculture research in India. The present research attempts at delineating the practices, processes, procedures in crop sciences in regard to research. Constructivist account helps us to understand the values, norms, standards which evolve into cultural outcomes and have a bearing on the practices of scientific community within the establishments of agricultural research in the country.

## **Objectives**

Modernity entails scientific rationality that offers empiricist explanations of worldly phenomena, including crop production. Situated in rational approach, crop sciences focused primarily on productivity and attempts made by the researchers in crop sciences in that direction have been met with results that range from progressive to retrogressive. Moving beyond the linear model of modern science paradigm, alternatives to standard crop

production have started to emerge outside the scientific realm. A critical understanding of the perceptions of the scientists working in the institutions of crop science is the need of the hour when the global agriculture is going to be controlled by few transnational corporations who are equipped with ideology, policy and proprietary rights. The present study thus aims at bringing out the constraints within the institutional system which obfuscate the initiatives to pursue research for public good outside the normative framework. It aims at understanding the perceptions of agricultural scientists on the a) issues related to research and b) the contemporary status of agriculture in the country and particularly on the research outcomes as perceived by farmers.

### **Methodology**

Data for the study were collected from scientists located in agricultural science institutions in the country. Data from the key informants located in institutions and universities like Indian Rice Research Institute, Directorate of Rice Research, IARI, and state Agricultural universities and research stations in Tamil Nadu, Karnataka and Orissa were collected through personal in-depth interviews which helped in developing the data instrument i.e. questionnaire. The crop science institutions were identified and a few were shortlisted based on factors like approachability, access, willingness of the scientists to respond to the questionnaire.

### **Area of the study**

The fields of the research study are agricultural research institutions and universities. The respondents of the study are scientists researching in crop sciences. The respondents are located in various state and central agricultural universities and research institutions in the country. Thus the study is an all-India based.

### **Sample selection**

The sampling units of the study are individuals working as scientists. Identification of scientists from among a large pool of agricultural scientific community is done through non-probability methods like purposive sampling and snow ball sampling.

### **Tools of data collection**

Data were collected using a questionnaire. It was developed based on the preliminary study conducted by the researcher. Based on the feedback from the scientists with whom the

researcher had personal formal interaction, the final questionnaire was developed. The researcher visited the institutions across the country and met the scientists personally for data collection. The scientists were approached during the working hours of the institution and informed about the purpose of the study. The questionnaires were handed out to the scientists and the filled in questionnaires were collected back on the scheduled date. It may be said that the rate of return of the questionnaire is about 85 percent. More importantly, the scientists working in the departments of agronomy, plant protection (entomology, plant pathology), agriculture extension, plant breeding and plant physiology were approached. The departments were selected based on the assumption that these are the key departments in the agriculture science research as they research on the problems faced by farmers and their outcomes have a direct bearing on farmers.

## **Chapter-II**

### **Crop production and its tryst with modern science**

The entry of science into agriculture, particularly into crop production, began in Europe in the first half of the nineteenth century. ‘The application of science in agriculture began in 1834 when Boussingault laid the foundations of agricultural chemistry’ (Howard, 1940: 146). Boussingault, a French chemist, was the first researcher in agriculture to devise a theory on plant nutrition which was labelled as humus theory. Humus theory, which explained the role of humus as source of plant nutrients, was later on demolished by the mineral theory of plant nutrition proposed by Liebig (McCosh, 1984: 131). The mineral theory with its strong foundation in chemistry in fact carried agriculture science into the fold of chemistry (Howard, 1940: 147). With the scientific establishment of the importance of chemical fertilizers namely, nitrogen, phosphorous and potash, in short NPK, it may be claimed that soil science, with heavy inputs from chemistry, was the first science that evolved in agriculture. Soil chemistry was the watershed in the history of agriculture not only for exponential expansion in sciences in agriculture in the years to come but also for heralding industrial incursion into agriculture. When the limitations of chemistry to address the problems of soil deficiencies were realized, other branches of sciences began to emerge. For example, Pasteur’s work on soil organisms and Charles Darwin’s account of complex life of soil, and Winogradsky’s work on nitrification of organic matter, and other advances led to the emergence of sciences like soil bacteriology, pedology, etc. (*ibid*).

The important shift in agricultural science occurred in the twentieth century when the researchers began to pay more attention to plant itself rather than other agents of crop production such as soil and other organisms. The science of plant breeding, benefitting greatly from the advances in botany, suggested for working with plant phenotypes to increase yields and to overcome diseases. If the early sciences in agriculture addressed the non-human aspects of crop production, the first social sciences to gain entry into agriculture was economics. Economics, though confined to the experimental statistics part of crop production in the initial years, shifted the focus of researchers to efficient organization of production in terms of cost and profit in the later stages. Resulting in the changed outlook, economists set the agenda of productivity and efficiency for agricultural research. Alongside it also drew strong criticism from others who argued that economics

looked at ‘the output of the farm and the factory from the same standpoint – dividends’ thus leading ‘agriculture to the ranks of industry’ (Howard, 1940: 149).

The developments in agricultural sciences were also greatly influenced by the political economy of the World Wars which effected a significant shift in the sciences of crop production. During the War period the factories in the Europe were engaged in the fixation of atmospheric nitrogen for the manufacture of large quantities of explosives. These factories which lost major market by the end of war found a potential market for ammonia fertilizers, as research in chemistry successfully demonstrated the potential of chemical fertilizers in crop production. Thus began the mass production of NPK fertilizers for agricultural use, the benefits of which were proved by science beyond doubt. The chemical fertilizers, which were available at cheaper costs, have made phenomenal impact on the political economy of agriculture in the world. Later, the fertilizer producing companies of Europe grew economically to unprecedented levels and changed the course of science and research in agriculture in the years to come. Although this was witnessed all over the world, the impact was more prominent on developing countries’ economies.

### **Indian agriculture and scientific institutions**

Knowledge of crop production in India precedes scientific inquiry and experimentation that began during the British period. The knowledge and tools of agriculture have a long history in India and are closely associated with India’s civilization. Although historical evidence suggests at the state interventions in agriculture in terms of construction of irrigation tanks during the pre-British period, the first systematic effort at scientific understanding of crop production in India began during the British rule. Faced with the problem of recurring famines in India, the British administration, during the late nineteenth century, looked at sciences for solutions. By this time significant advances in the agricultural sciences have been witnessed in Europe. Embarking on the systematic application of science in crop production the British administration appointed Voelcker, the consultant chemist with the Royal Society of England, for suggestions on improvement of Indian agriculture. Voelcker recommended for the development of scientific enquiry as he believed that it is the domain of science that can explain the principles underlying good cultivation practice, and can help to extend the applications of these principles to make fresh discoveries that benefit agriculture. Also, the need for scientific enquiry in agriculture was highlighted by the Famine Commission and the

Government of India recognized that scientific enquiry into agricultural practices was a prerequisite for agricultural improvement. It may be noted that the initial experiments in agriculture in India were manorial experiments with fertilizers taken up by the British in experiment stations set up as part of scientific inquiry into agriculture.

However, the first institutional attempt in agriculture in India began with the creation of Departments of Agriculture based on the recommendations of the Famine Commission Report of 1880. The departments, apart from carrying out famine relief works, were mandated to conduct scientific enquiry into agriculture practices for improvement. However, by 1890 the need for augmenting agricultural enquiry was realized with the recognition that the Agricultural Departments were inadequate to carry out such a system of enquiry. Based on the observations of J.A. Voelcker that 'the Directors of Departments of Land Records and Agriculture are primarily occupied with administrative duties, and have neither time nor the technical acquaintance with agriculture which would enable them to devote themselves to the subject of agricultural improvement' (Voelcker, 1894: p310), a permanent agency for the purpose of agriculture enquiry was set up in 1890. The recommendations of Voelcker, consequently led to the appointment of the Imperial Agricultural Chemist in 1892, the Imperial Mycologist in 1901, and the Imperial Entomologist in 1903. This was the beginning of inducting scientific approach into Indian agriculture. Any historiographic account on science in Indian agriculture recognizes the contributions of Voelcker whose recommendations formed the basis for the establishment of the Imperial Agricultural Research Institute in 1905 at Pusa, in Bihar (now known as Indian Agricultural Research Institute, located at New Delhi). Similar initiatives in livestock research also began with the establishment of the Imperial Bacteriological Laboratory (now known as Indian Veterinary Research Institute) in 1889 at Pune.

### **Rise of scientific institutions in agriculture in India**

Institutional research in agriculture in India got impetus with the establishment of Imperial Council of Agricultural Research (ICAR) in 1929 based on the recommendations of the Royal Commission on Agriculture. After independence it was renamed as the Indian Council of Agricultural Research (ICAR). Specific crop based research began to emerge with the setting up of a number of Commodity Committees dealing with research in crops namely cotton, lac, oil seeds, tobacco, areca nut, spices, cashew nut, and other crops. In

1965 as part of the reorganization of the ICAR the Commodity Committees were abolished and were merged with ICAR. All the federal funded research activities relating to crops, commodities, animal sciences, and fisheries were brought under one umbrella. Keeping the peculiarities of the vast and varied agro-climatic conditions of the country in mind, Regional Committees were set up for eight agro-ecological zones. Along with the establishment of agricultural universities, to provide education and research in agriculture, Agricultural Scientists Recruitment Board was created to recruit agricultural scientists to work in various research institutes and projects of the ICAR. Other major programmes such as All India Coordinated Research Projects and National Agricultural Research Project (NARP) have been launched subsequently to strengthen research capabilities in various agricultural research universities across the country (Balaguru, undated).

### **The present system**

Over the years, Indian agricultural research system evolved into one of the largest agricultural research systems in the world employing about 31,000 scientists engaged in agriculture research and education (Mruthyunjaya and P Ranjitha 1998). The ICAR, the public funded organization, directly monitors and administers research in the areas of crop, animal and fishery sciences. The agriculture research, education and training is overwhelmingly under public sector carried out by various institutes at national, state and zonal level spread all over the country. There are four multidisciplinary national institutes engaged in research, teaching and training for manpower development in agriculture, animal husbandry, fisheries and agricultural extension. They are Indian Agricultural Research Institute (IARI), Indian Veterinary Research Institute (IVRI), National Dairy Research Institute (NDRI), Central Institute of Fisheries Education (CFIE) and National Academy of Agricultural Research Management (NAARM). There are sixty-five central research institutes located in various parts of the country carrying out basic and applied research in agriculture and allied sectors (see Table 1). Apart from these, ICAR also promotes research schemes / projects related to agriculture and allied areas in collaboration with research institutions in the country through All India Coordinated Research Projects (AICRPs). The AICRPs are problem oriented projects which provide common platform for scientists working on similar problems from different institutions to exchange information and expertise on specific crop or problem. The first AICRP was established in 1957 in maize crop and the success of this later on led to the establishment of 60 such projects on various crops and problems. The AICRPs are considered as vital

components of agriculture research India (Alam, 2004). Similar to the coordinated research projects there are twenty five Project Directorates in the country entrusted with the responsibility of maintenance and supply of germplasm and monitoring pests, diseases, etc in specific crops such as rice, wheat, poultry and oil seeds. The National Research Centers, which are fifteen in number, consist of scientists from different disciplines working on problems related to particular crop or commodity or a problem area of research with national relevance. The six National Bureaux established by the ICAR collect and conserve genetic resources in plants, animals, fish and soil and microorganisms with an aim at long term productivity.

Another key initiative of the ICAR is the establishment of Krishi Vigyan Kendras (Farm Science Centres), popularly referred to as KVKs, with an aim to assess, refine and demonstrate agricultural technologies at the field level. There are 706 KVKs covering all the districts in the country. They are mandated to conduct on-farm trials on various agricultural technologies, organize frontline demonstrations to establish potential of the new technology or practice or variety, conduct training camps for farmers to update, transfer knowledge and skills in modern agricultural technologies and train extension personnel to orient them in frontier technology development. Based on the recommendations of the Committee on Independent Evaluation and Impact Assessment of KVKs. The KVKs are assigned the task of acting as resource and knowledge centres of agricultural technology for supporting public, private and voluntary initiatives for improving the agricultural economy of the districts.

**Table 1: ICAR research institutions involved in agricultural research and education in India**

<b>ICAR Research Institutions</b>	<b>Number</b>
ICAR Institutions	65
National Research Centres	15
All India Coordinated Research Projects	60
Network Projects	19
Other Projects	10
Directorates/Project Directorates	13
National Bureaux	6
Krishi Vigyan Kendras	706
State Agricultural Universities	64
Central Agricultural Universities	3
Deemed Universities	4

Source: <https://icar.org.in>

### **Agricultural education in India**

Inculcating scientific temper among young students, training them in scientific inquiry and equipping them with skills in agricultural research were soon recognized as important prerequisites for furthering scientific research in agriculture. The University Education Commission (1949) thus recommended for setting up of 'Rural Universities' (Balaguru, undated). Also, the first and second Joint Indo-American Team reports submitted in 1955 and 1959 respectively as well as the Ford Foundation Study Team of 1959 recommended the formal teaching of agricultural sciences at university levels. On the recommendations made by Agricultural Universities Committee constituted under the Chairmanship of Dr Ralph W. Cummings in 1960, the ICAR developed a model act that proposed for setting up of agricultural universities in India in collaboration with six US Land Grant Institutions (Randhawa, 1968). The agricultural universities set up in collaboration with the US Land Grant Colleges are Uttar Pradesh Agricultural University (collaborating LGC (CLGC)- University of Illinois), Punjab Agricultural University (CLGC- Ohio State University), Andhra Pradesh Agricultural University (CLGC- Kansas State University), University of Udaipur (CLGC- Ohio State University), Jawaharlal Nehru Krishi Vishwa Vidyalaya (CLGC- University of Illinois), Orissa University of Agriculture and Technology (CLGC- University of Missouri), Mysore University of Agricultural Sciences (CLGC- University of Tennessee), and Maharashtra Agricultural

University (CLGC- Pennsylvania State University). The collaborating Land Grant Colleges trained teachers of the Indian agricultural universities and provided equipment grant for research. Agriculture education in India, as a specialized course, begins at the under graduation level.

Based on the recommendations of the Second Education Commission (1964-66) for setting up at least one agricultural university in each state and as per the guidelines of the ICAR's Model Act in 1966, one agricultural university was set up in every state. However, now many states have multiple universities to meet regional needs. There are at present 64 State Agricultural Universities, 3 Central Universities offering agricultural courses, and four deemed universities (ICAR, 2018)

Since independence, agricultural science in India responded to the needs of the country and agriculture research played a crucial role in achieving the insurmountable task of food security to its burgeoning population. The scientific community responded to the task with nationalist zeal and successfully demonstrated the social responsiveness of science. Along with many divisions in ICAR crop science is the division that anchors research programmes in food grain and non-food grain crops. The crop science division with its network of 13 national institutes including a deemed-to-be-university, 3 bureaus, 9 project directorates, 2 national research centres, 27 all-India coordinated research projects, and 5 all-India network projects focuses on 6 commodity/subject-specific technical sections, namely, (i) Food and Fodder Crops, (ii) Oilseeds and Pulses, (iii) Commercial Crops, (iv) Seeds, (v) Plant Protection, and (vi) Intellectual Property Rights (ICAR, 2011). The crop science claims to have developed nearly 3,300 high-yielding varieties/hybrids of field crops for different agro-ecologies, which raised productivity in food grains by two to four folds since 1950-51. Embarking on advanced technological development the crop sciences division of ICAR forayed into biotechnology research as well (<https://icar.org.in>).

### **Agricultural research and social outcomes**

Any discussion on science in agriculture in India would be incomplete without a reminiscence of the contributions of crop sciences to green revolution. Scientists and the scientific institutions worked as a collective towards realizing the national goal of achieving food security. The strategies evolved and disseminated to augment crop production, comprising a set of practices like use of high yielding variety seeds responsive

to fertilizers and water, and adoption of scientific cultivation procedures, together referred to as green revolution technology. Apart from the state policy interventions in land reforms, irrigation infrastructure, extension system and institutional credit, minimum support price, etc. the science of crop production played a commendable role in improving productivity in a number of crops. Biplab Dasgupta (1977) attributes the success to 'miracle seeds' suggesting that it is because of the dwarf variety seeds used in the green revolution technology more yields were possible. Phenomenal growth in productivity in crops like rice, wheat was possible because of new seeds developed in the science of plant breeding. Ladejinsky (1973) claims that green revolution technology transformed the traditional Indian agriculture into 'modern' with a package of new practices. According to D N Dhanagare (1987) green revolution is a package, involving both ideology and practice, of 'large scale application of modern science and technology to agriculture' and hence green revolution has to be understood as a broader ideology of rural transformation. Green revolution was viewed as a solution for rural poverty and hunger. However, others reject such notion because green revolution was very selective and its spread undermined long term agricultural sustainability (Bardhan, 1985). In the same vein, through a number of empirical works they also brought forth the unintended consequences of green revolution on the Indian social, political and economic structure to the centre stage of development discourse which in a way contributed to the shift in the epistemology of crop sciences in the years to come.

India's tryst with food production begins with green revolution. Green revolution in India stands testimony to socially responsive public policy. It may be hailed as the benchmark for the collaborative role of research, public policy and executive. It was the state policy that catalyzed research, development and diffusion of agricultural innovations. The role of state institutions in research and extension was pivotal in the success of green revolution. Many high yielding varieties and hybrids in food and non-food crops were introduced through research by agricultural scientists working for various state funded research stations and universities. The zeal with which these technological innovations have been diffused was remarkable. With the concerted efforts by the scientists new high yielding, pest/disease resistant, stress tolerant and quality varieties have been developed.

It is equally important to note that green revolution can also be considered as the best example for what public domain research can do to a developing country like India.

The results of the research were disseminated through a nation-wide network of extension system. As a result, from the stage of chronic food shortage, India reached the stage of exporter of food grains. The growth rates in area under major crops depicted in Table 2 suggest that since 1955 India made significant strides in production with the substantial increase in the area under cultivation.

**Table 2: Area under major crops from 1950-51 to 2015-16 (in millions hectares)**

Crops	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Rice	30.81	34.13	37.59	40.15	42.69	44.71	42.86	44.01	42.75	44.14	44.11	43.50
Wheat	9.75	12.93	18.24	22.28	24.17	25.73	29.07	29.86	30.00	30.47	31.47	30.42
Nutri Cereals	37.67	44.96	45.95	41.78	36.32	30.26	28.34	26.42	24.76	25.22	25.17	24.39
Pulses	19.09	23.56	22.54	22.46	24.66	20.35	26.40	24.46	23.26	25.21	23.55	24.91
Foodgrains	97.32	115.58	124.32	126.67	127.84	121.05	126.67	124.75	120.78	125.04	124.30	123.22
Oilseeds	10.73	13.77	16.64	17.60	24.15	22.77	27.22	26.31	26.48	28.05	25.59	26.08
Sugarcane	1.71	2.42	2.62	2.67	3.69	4.32	4.88	5.04	5.00	4.99	5.06	4.92
Cotton	5.88	7.61	7.61	7.82	7.44	8.53	11.24	12.18	11.98	11.96	12.81	12.29
Jute & Mesta	0.57	0.90	1.08	1.30	1.02	1.02	0.87	0.90	0.86	0.83	0.81	0.78

Sources: [http://agricoop.nic.in/sites/default/files/pocketbook\\_0.pdf](http://agricoop.nic.in/sites/default/files/pocketbook_0.pdf)

Source: Department of Agriculture, Cooperation & Farmers Welfare

The discourse on green revolution in social sciences deals with the role of the scientific institutions, as a part of a larger discussion on the social impact of green revolution technology. The extent of attention paid to assess the social impact of green revolution often overlooks the contributions of science to society. The efforts of the scientific community towards meeting the challenges of the time and the institutional mechanism that ensured research have been either missed out or did not get due attention. It is not an exaggeration to suggest that without the establishment of scientific institutions in agricultural research and education and the nurturing of scientific rationality such a progress in agriculture wouldn't have been possible. Often while dealing with growth in agriculture social scientists give credit to the institutional measures in credit, irrigation and price policies disregarding the role of scientific institutions.

It is important to recognize the contributions of crop sciences not only for realizing the ultimate goal of achieving self sufficiency in food grain production but also for the manner the institutions tackled the problems which cropped up during the course of addressing the national food challenges. For example, the knowledge of crop production borrowed from the West was not always suitable and the scientists had to work out ways

for its adaptation. Similarly, when a HYV seed variety addressed the problem of productivity, its susceptibility to certain pests and diseases posed new challenges. The context of application of scientific outcomes was a challenging task which the scientific institutions addressed by expanding or entering into new areas of research by establishing institutions with specific mandate.

However, a critical appraisal suggests that the process of institutionalization of agricultural research has its epistemological basis in the empiricist-positivist tradition and has been linear. The institutional setup in agricultural research in the country was grounded on the borrowed methodologies and ideologies. The most important critical observation from social scientists on green revolution is about its unintended social consequences (Ladejinsky, 1973; Dhanagare, 1987; Joshi, 1999). Studies on the social consequences of green revolution claim that the seed-fertilizer-irrigation intensive strategy of crop production paved way for capitalist transformation of Indian agriculture through industrial products such as chemical fertilizers, synthetic insecticides and herbicides. Large farmers, endowed with financial resources and access to agricultural information benefited with green revolution while the small and marginal farmers lost out to the wild market forces. The high-cost and high-yield green revolution technology, particularly in cereal crop cultivation, forced unsustainable capital investments, beyond the means of a majority of small and marginal farmers pushing a large section of small, marginal and tenant farmers into debt trap. Dhanagare (1987) observes that, owing to the capitalist penetration of the countryside, the process of de-peasantisation has been accelerated and consequently a large number of small and marginal farmers or poor peasants have been pushed to the ranks of landless labourers. Green revolution technology changed the production and productivity in the irrigation areas but it neither benefited the non-irrigated regions nor addressed the problems related to farming in the dry regions (Joshi, 1999). Agarwal (1981) points out that 'the fruits of green revolution technology have been pocketed mainly by big farmers and the disparity between the rich and the poor has further increased'. The intensive cultivation practice of green revolution demands high labour use which only the affluent farmers can afford (Ladejinsky, 1973). D K Gill and S K Saini (1991) report that the benefits of capital intensive green revolution were differentially distributed across the rich and poor farmers owing to the economic inequalities. The rich farmers could reap benefits while the poor farmers benefited only marginally because of their incapacity to afford to adopt new technology. In some cases the green revolution

'trinity' of chemical fertilisers, pesticides and hybrid seeds brought the majority of peasants both into indebtedness and into dependence on multi-nationals and the state (Omvedt, 1991).

As a corollary, divergent views on the relevance of green revolution technology began to emerge. It is argued that the HYV and fertilizer technology is neither feasible nor desirable for Indian conditions (Bhatia, 1988). At another level, on the environment front, it is reported that green revolution led to contamination and exploitation of natural resources. Indiscriminate use of ground water for irrigation, non-judicious use of chemical fertilizers and pesticides brought the questions of sustainable development to the agendas of researchers in crop sciences. Moreover, issues such as susceptibility of crop varieties to new pests and diseases, perceived inability of crop sciences to augment yield potential using conventional crop science research tools raised concerns about the limitations of green revolution and paved way for new scientific approaches such as molecular biology.

Asides, a number of factors related to agriculture contributed to the shift in crop sciences from productivity-efficiency linked growth to sustainable development. Factors such as advances in molecular biology, globalization induced trade agreements and intellectual property rights, rise of transnational companies in agriculture, economic restructuring in the developing countries have changed the research agendas and processes in crop sciences, affecting the institutional context as well. Particularly, advances in molecular biology offered opportunities for proprietary knowledge in agriculture. The formalization of world trade also necessitated the scientific institutions in developing countries to effect compatible regimes and innovation systems with the intellectual property regime. The shift in the nature and priorities of research in crop sciences is critical in the evolution of science of crop production as it marked the beginning of proprietary research, a greater amount of which is located in the private domain. This shift is critical for social scientists too because it also effected changes in the social relations of research/knowledge production denoting the drift from public funded institutions to private research organizations. The shift may be found in other sciences too, however, in crop sciences it attracts greater attention of the social researchers, particularly those working in the area of science, technology and society studies because crop sciences founded the basis not only for food security of the nation but also for equitable distribution and access.

## **Emerging social context of agriculture**

When India adopted GR from the US ‘the USAID’s expressed goal was to effect rapid social change by working with elites in a top-down fashion’ (Raina 2006). Unfortunately this remains the framework of crop sciences even today. The notion of ‘progressive farmer’ who combines ownership of land and capital with skills in manipulating both ‘traditional and modern’ institutions (Beteille 1974) apparently is becoming irrelevant in the present context. This is because the so called progressive farmers of the GR era have vanished from agriculture. Even those farmers from upper castes who are engaged in agriculture are reluctant farmers. Majority of the farmers today belong to lower social strata. The demographic profile of farming community is fast changing (Sharma 2007). Present day farmers’ socio-economic profile, age, gender and disposition towards agriculture are completely different from that of the farmers of green revolution period. It is a reality that as upper caste, educated, young men in villages have distanced from agriculture, or disinclined to be engaged in agriculture new sections of farmers are emerging (Jodhka 2012). The emerging agrarian scenario should be a cause of concern for the crop science research. The swelling numbers of small and marginal farmers point towards the impending need to streamline and orient agricultural research to the needs of these sections of farmers. The institutions of crop sciences appear to be oblivious to this emerging scenario.

Agriculture in India is undergoing radical changes in the post liberalization era owing to multiple factors. With the launching of economic reforms based on neo-liberal agenda the practice of cultivation became knowledge intensive, commercialized, competitive and globalized. The change is also witnessed in the form of rapid decline of state in agriculture extension and other services to the farming community.

Structurally today’s agriculture is dominated by small and marginal farmers operating small holdings. All India Report on the Number and Area of Operational Holdings released by the Agriculture Census Division Department of Agriculture, Co-Operation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare Government of India, 2018 suggests that the total number of operational holdings in the country has increased from 138 million in 2010-11 to 146 million 2015-16 i.e. an increase of 5.33% and the average size of operational holding has declined to 1.08 ha. in 2015-16 as compared to 1.15 in 2010-11.

There is a constant rise in marginal and small holdings and decline in the large holding since 1970 (see Tables 3 and 4). Also the report on the Agriculture Census of 2015-16 reveal that there is a rise in the number of women farmers, scheduled caste farmers and scheduled tribe farmers in the country. Sociologically speaking, these farmers' disposition towards agricultural technologies, agricultural information, and most importantly towards state is different from that of upper caste, large farmers (referred to as progressive farmers) who were the blue-eyed boys of green revolution period. These sections of farmers present characteristics which cannot be explained in terms of classical diffusion of innovations approach. As these small and marginal farmers belong to lower strata in the society, their social, cultural and economic capital is poor when compared to the large farmers of the upper social strata. Vasavi (2012) maintains that these sections of farmers are caught by the 'web of risks' such as low risk taking ability, lack of required technical knowledge, lack of access to working capital and marketing networks, low investment, low productivity, weak market orientation, in the present day agriculture.

**Table 3: Number of operational holdings as per different Agriculture Censuses**

	197 0-71	197 6-77	198 0-81	198 5-86	199 0-91	199 5-96	200 0-01	200 5-06	201 0-11	2015 -16
Margin al	145 99	175 09	197 35	220 42	248 94	281 21	298 14	320 26	359 08	3796 0
Small	192 82	209 05	231 69	257 08	288 27	307 22	321 39	331 01	352 44	3643 5
Semi- Mediu m	299 99	324 28	346 45	366 66	383 75	389 53	381 93	378 98	377 05	3716 8
Mediu m	482 34	496 28	485 43	471 44	447 52	413 98	382 17	365 83	338 28	3136 7
Large	500 64	428 73	377 05	330 02	286 59	241 60	210 72	187 15	169 07	1421 2

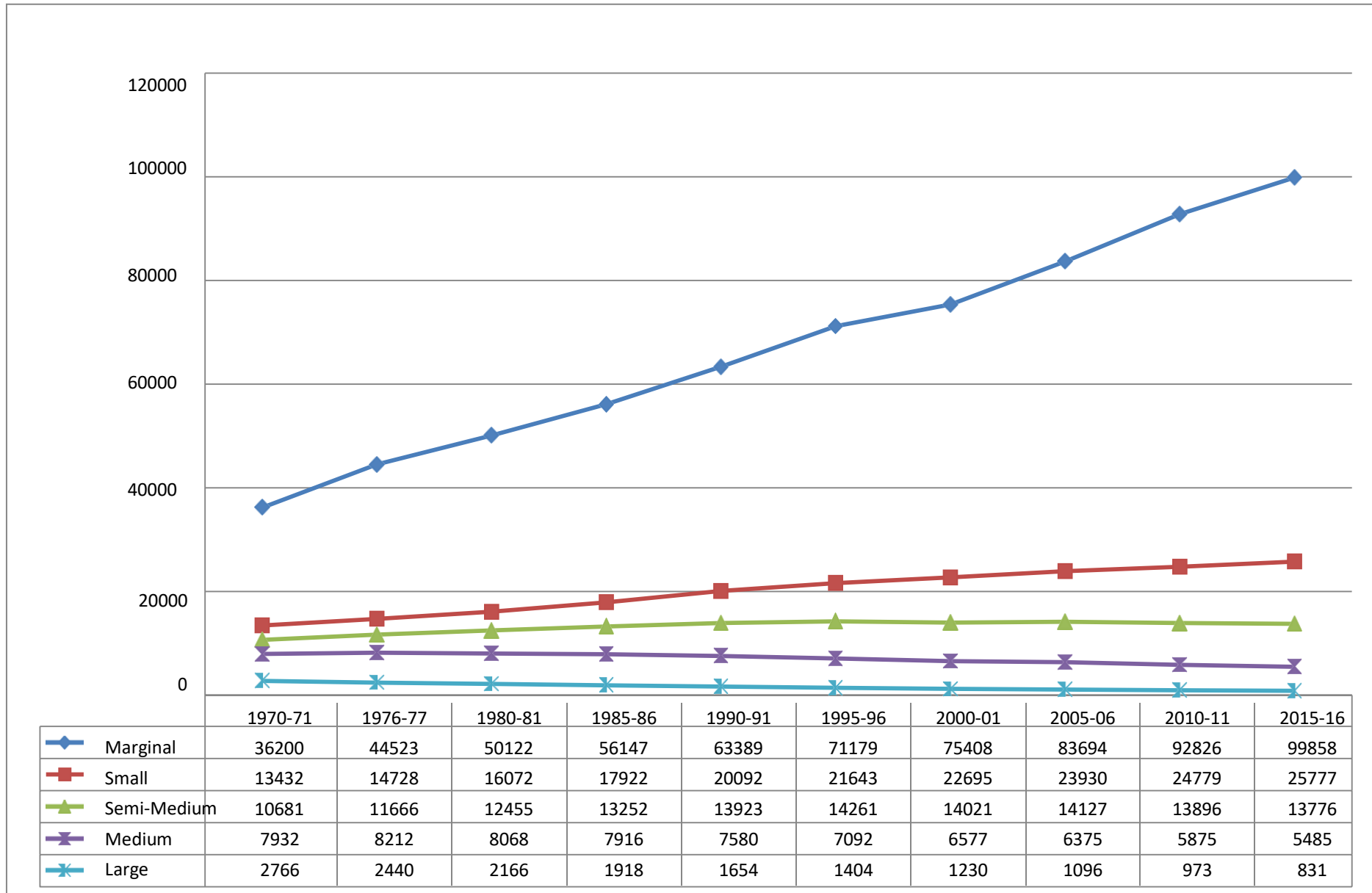
**Table 4: Area operated by operational holdings as per different Agriculture Censuses**

	197 0- 71	197 6- 77	198 0- 81	198 5- 86	199 0- 91	199 5- 96	200 0- 01	200 5- 06	201 0- 11	201 5-16
Margi nal	145 99	175 09	197 35	220 42	248 94	281 21	298 14	320 26	359 08	379 60
Small	192 82	209 05	231 69	257 08	288 27	307 22	321 39	331 01	352 44	364 35
Semi- Mediu m	299 99	324 28	346 45	366 66	383 75	389 53	381 93	378 98	377 05	371 68
Mediu m	482 34	496 28	485 43	471 44	447 52	413 98	382 17	365 83	338 28	313 67
Large	500 64	428 73	377 05	330 02	286 59	241 60	210 72	187 15	169 07	142 12

**Fig. 1: Trend in the operational land holdings in India between 1970-71 and 2015-16**

**(Number of operational holdings as per different Agriculture Censuses)**

(Source: [http://agcensus.nic.in/document/agcen1516/T1\\_ac\\_2015\\_16.pdf](http://agcensus.nic.in/document/agcen1516/T1_ac_2015_16.pdf) )



**Fig. 2: Trend in the area operated by operational holdings in India between 1970-71 and 2015-16**

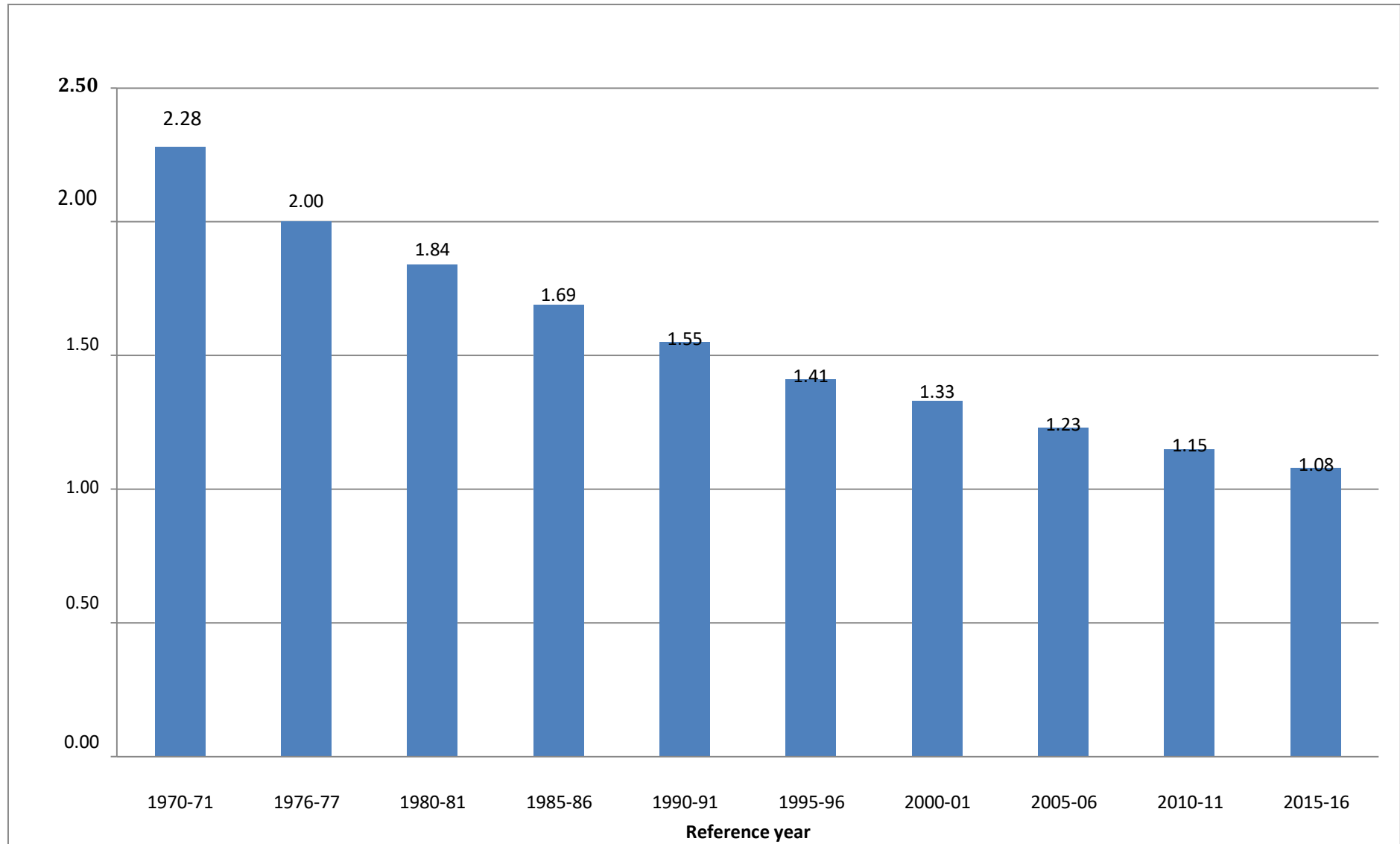
**Area operated by operational holdings as per different Agriculture Censuses**

(Source: [http://agcensus.nic.in/document/agcen1516/T1\\_ac\\_2015\\_16.pdf](http://agcensus.nic.in/document/agcen1516/T1_ac_2015_16.pdf) )



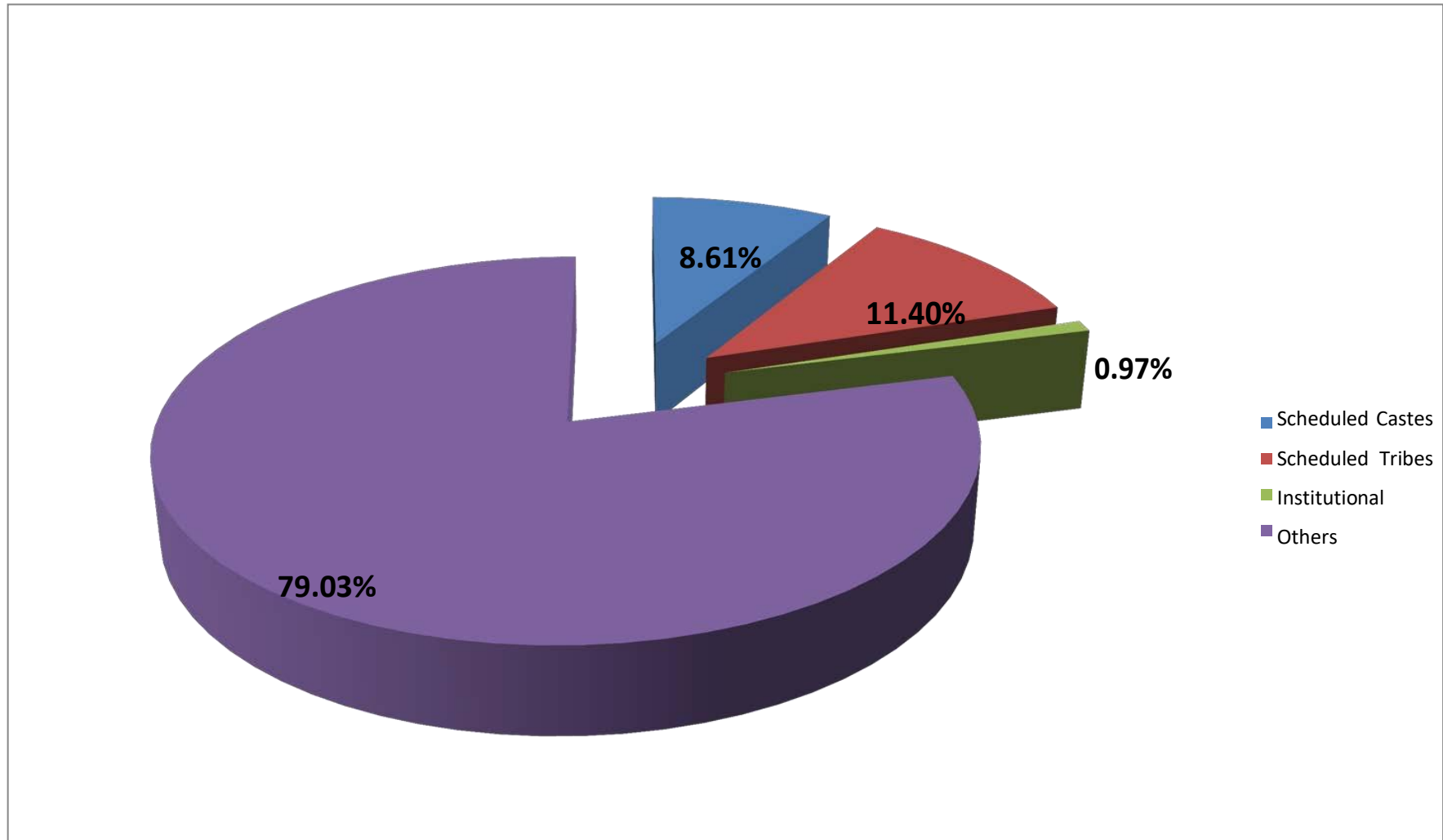
**Fig 3: Average size of operational holdings as per different Agriculture Censuses**

(Source: [http://agcensus.nic.in/document/agcen1516/T1\\_ac\\_2015\\_16.pdf](http://agcensus.nic.in/document/agcen1516/T1_ac_2015_16.pdf) )



**Fig. 4 Percentage share of different social groups in area operated by holdings as per Agriculture Census 2015-16**

(Source: [http://agcensus.nic.in/document/agcen1516/T1\\_ac\\_2015\\_16.pdf](http://agcensus.nic.in/document/agcen1516/T1_ac_2015_16.pdf) )



**Table 5: Number of holdings, operated area and average size of holdings (1970-71,1976-77,1980-81,1985- 86,1990-91, 1995-96, 2000-01, 2005-06, 2010-11 & 2015-16)**

**All Social Groups**

Sl. No.	Size Groups	Number of Holdings (in '000)									
		1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01*	2005-06*	2010-11	2015-16
1	Marginal	36200	44523	50122	56147	63389	71179	75408	83694	92826	99858
2	Small	13432	14728	16072	17922	20092	21643	22695	23930	24779	25777
3	Semi-Medium	10681	11666	12455	13252	13923	14261	14021	14127	13896	13776
4	Medium	7932	8212	8068	7916	7580	7092	6577	6375	5875	5485
5	Large	2766	2440	2166	1918	1654	1404	1230	1096	973	831
	All Sizes	71011	81569	88883	97155	106637	115580	119931	129222	138348	145727

Sl. No.	Size Groups	Operated Area (in'000 ha.)									
		1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01*	2005-06*	2010-11	2015-16
1	Marginal	14599	17509	19735	22042	24894	28121	29814	32026	35908	37960
2	Small	19282	20905	23169	25708	28827	30722	32139	33101	35244	36435
3	Semi-Medium	29999	32428	34645	36666	38375	38953	38193	37898	37705	37168
4	Medium	48234	49628	48543	47144	44752	41398	38217	36583	33828	31367
5	Large	50064	42873	37705	33002	28659	24160	21072	18715	16907	14212
	All Sizes	162318	163343	163797	164562	165507	163355	159436	158323	159592	157142

Sl. No.	Size Groups	Average (in ha.)									
		1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01*	2005-06*	2010-11	2015-16
1	Marginal	0.40	0.39	0.39	0.39	0.39	0.40	0.40	0.38	0.39	0.38
2	Small	1.44	1.42	1.44	1.43	1.43	1.42	1.42	1.38	1.42	1.41
3	Semi-Medium	2.81	2.78	2.78	2.77	2.76	2.73	2.72	2.68	2.71	2.70
4	Medium	6.08	6.04	6.02	5.96	5.90	5.84	5.81	5.74	5.76	5.72
5	Large	18.10	17.57	17.41	17.21	17.33	17.20	17.12	17.08	17.38	17.10
	All Sizes	2.28	2.00	1.84	1.69	1.55	1.41	1.33	1.23	1.15	1.08

\* Excluding Jharkhand.

**Table 6: Number of holdings, operated area and average size of holdings (1970-71,1976-77,1980-81,1985- 86,1990-91, 1995-96, 2000-01, 2005-06, 2010-11 & 2015-16)**

### Scheduled Castes

Sl. No.	Size Groups	Number of Holdings (in '000)									
		1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01*	2005-06*	2010-11	2015-16
1	Marginal	-	-	6923	8508	9689	10844	11385	12233	13247	13547
2	Small	-	-	1644	1923	2130	2275	2318	2445	2464	2471
3	Semi-Medium	-	-	952	1067	1092	1099	1019	1014	1005	975
4	Medium	-	-	438	456	432	400	357	326	330	313
5	Large	-	-	95	87	79	71	62	56	52	48
	All Sizes	-	-	10052	12041	13422	14688	15140	16073	17099	17355

Sl. No.	Size Groups	Operated Area (in '000 ha.)									
		1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01*	2005-06*	2010-11	2015-16
1	Marginal	-	-	2510	3000	3409	3835	4074	4494	4867	4952
2	Small	-	-	2324	2713	3010	3176	3237	3364	3455	3451
3	Semi-Medium	-	-	2576	2878	2944	2939	2716	2693	2678	2584
4	Medium	-	-	2554	2636	2492	2291	2040	1865	1885	1778
5	Large	-	-	1557	1413	1319	1164	1009	883	836	761
	All Sizes	-	-	11521	12639	13173	13406	13077	13300	13721	13526

Sl. No.	Size Groups	Average (in ha.)									
		1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01*	2005-06*	2010-11	2015-16
1	Marginal	-	-	0.36	0.37	0.35	0.35	0.36	0.37	0.37	0.37
2	Small	-	-	1.41	1.41	1.41	1.40	1.40	1.38	1.40	1.40
3	Semi-Medium	-	-	2.71	2.70	2.70	2.67	2.67	2.66	2.66	2.65
4	Medium	-	-	5.84	5.78	5.77	5.73	5.72	5.72	5.70	5.67
5	Large	-	-	16.44	16.24	16.70	16.48	16.27	15.91	15.99	15.72
	All Sizes	-	-	1.15	1.05	0.98	0.91	0.86	0.83	0.80	0.78

\* Excluding Jharkhand.

**Table 7: Number of holdings, operated area and average size of holdings  
(1970-71,1976-77,1980-81,1985- 86,1990-91, 1995-96, 2000-01, 2005-06,  
2010-11 & 2015-16)**

**Scheduled Tribes**

Sl. No.	Size Groups	Number of Holdings (in '000)									
		1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01*	2005-06*	2010-11	2015-16
1	Marginal	-	-	2728	3161	3763	4376	4429	5118	6470	7135
2	Small	-	-	1551	1795	2087	2336	2411	2650	2877	2994
3	Semi-Medium	-	-	1405	1545	1694	1778	1653	1700	1787	1773
4	Medium	-	-	936	936	943	898	783	763	760	702
5	Large	-	-	234	212	183	135	128	112	111	97
	All Sizes	-	-	6854	7648	8670	9523	9404	10343	12005	12701

Sl. No.	Size Groups	Operated Area (in'000 ha.)									
		1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01*	2005-06*	2010-11	2015-16
1	Marginal	-	-	1309	1512	1839	2131	2159	2468	3144	3433
2	Small	-	-	2220	2563	2996	3332	3421	3692	4119	4249
3	Semi-Medium	-	-	3850	4225	4635	4802	4452	4542	4831	4756
4	Medium	-	-	5596	5570	5550	5202	4538	4397	4363	3995
5	Large	-	-	3729	3365	2888	2058	1955	1831	1763	1475
	All Sizes	-	-	16704	17234	17909	17524	16525	16929	18221	17908

Sl. No.	Size Groups	Average (in ha.)									
		1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01*	2005-06*	2010-11	2015-16
1	Marginal	-	-	0.48	0.48	0.49	0.49	0.49	0.48	0.49	0.48
2	Small	-	-	1.43	1.43	1.44	1.43	1.42	1.39	1.43	1.42
3	Semi-Medium	-	-	2.74	2.73	2.74	2.70	2.69	2.67	2.70	2.68
4	Medium	-	-	5.98	5.95	5.89	5.79	5.80	5.76	5.74	5.69
5	Large	-	-	15.88	15.87	15.78	15.24	15.26	16.32	15.95	15.23
	All Sizes	-	-	2.44	2.25	2.07	1.84	1.76	1.64	1.52	1.41

\* Excluding Jharkhand.

Sociologically significant paradox that is emerging in today's agriculture is that on one hand we see the rising numbers of 'dalit' and tribal farmers, on other hand the failure to see this reality by the institutions of crop science. The agricultural scientific community believes that agricultural technologies are *asocial* and thus caste is irrelevant. However, it is to be realized that a 'dalit' farmer's disposition towards agricultural technologies, services, scientific knowledge is definitely different from that of an upper caste farmer. It is because an upper caste farmer's economic, social and cultural capital enables him/her to access and benefit from scientific knowledge. For example, the response of an agriculture officer to a 'dalit' farmer would surely be different from that of an upper caste farmer. The other side of it is that farmers from lower social strata have always distanced themselves from scientific knowledge as it carries the burden of green revolution legacy that privileged progressive farmer. Vasavi (2012: 92) suggests that agricultural knowledge diffusion has never been *apolitical*. Quoting Kumbamu (2009) 'aggressive marketing strategies such as demonstration plots are not simply neutral experiments in the field but are interwoven with power relations and social relations, which thereby reinforce inequities in the rural society', Vasavi highlights the cultural schisms in the institutions of science. It is also a well known fact that majority of the field trails, demonstrations, etc. conducted by the agricultural scientific community are carried out in the fields of progressive farmers belonging to upper castes of the village. It is not to cast aspersions but to suggest that such innocuous acts in fact distanced 'dalit' and tribal farmers from accessing scientific knowledge for a long time. Such agricultural knowledge dissonance (Vasavi 2012) is having a debilitating effect on farmers from lower social strata with small and marginal holdings.

### **Epistemological conundrum**

Crop sciences, since its formal accreditation as scientific knowledge by the modernists, overwhelmed other approaches towards crop production. Alternate knowledge claims, emerging from outside the precincts of science, have been posing challenges to the dominant green revolution paradigm in the recent past. For example, System of Rice Intensification (SRI) as a civil society innovation differs from modern crop science as it evolved from the experiments and observations of a religious priest which soon caught the attention of the proponents of alternatives to GR paradigm. Norman Uphoff (2008) calls SRI technology as *post modern agriculture*, because a) it is evolved with a greater

participation of farmers and non-scientists in the process of innovation and evaluation and b) it didn't emanate from formal-science but evolved as a civil society innovation. Similarly, experiments with Non-pesticidal management, organic farming eschew linear models of agricultural research and development in favour of a more participatory, reciprocal style and considers farmers not just as adopters but as key partners.

These alternate knowledge claims raise both epistemological and ontological questions on basic components of crop production such as plant, soil, microorganisms, environment, etc. For example, the assumption of rice as an aquatic plant is seriously contested by the proponents of SRI as they suggest that rice could be grown even under semi-wet conditions. The epistemological assumptions of green revolution on soil, chemical fertilizers and irrigation water have been questioned through successful demonstration of superiority of SRI over conventional green revolution based rice cultivation. Similarly, the proponents of organic farming claim that positivist, linear models of research crave for observable results whereas the desired results from organic farming may be realized in the due course of cultivation, may be after two or three successive seasons. For example, improvement of soil health may be assessed through indicators such as increased presence of living organisms like earthworm and morphological characters of soil like colour and texture. Farmers who have been using chemical fertilizers report the hardening of soil because of continuous use of chemical fertilizers. Those who have switched over to organic cultivation claim to have noticed the change in soil nature as it began to host many beneficial living organisms. The outcomes or desired results from non-linear methods of cultivation may be tangible over a period or may not be tangible. Unfortunately, the institutions of science often discard the non-linear methods of science by subjecting them to linear positivistic tests. Das (2007) observes that 'conversion from a traditional low external input system of cultivation rarely results in lower yields. However, when switching from external input intensive forms of agriculture, the yield may decline significantly, at least in the initial years of conversion - until the natural soil tilth and fertility are sufficiently developed'.

Critical appraisals of contemporary agriculture point out the bias of the state institutions of science towards green revolution technology. Locating the ideological bias in the adoption of US Land Grant Colleges model Rajeswari Raina (2009) contends that India 'decided to forget the philosophy and transfer the model instead'. Emphasis on

western model is often credited to have scuttled other alternate approaches towards crop production. Such an approach has not posed greater risks to farmers as long as the deliverables were located in the public domain and farmers received them through state interventions. Arguing for reorienting agricultural research in the light of ‘evidence of the unfavourable ecological footprint of the industrial agricultural paradigm, ominous climate changes, and embarrassing social and economic crises in India manifested in farmers suicides over the last decade’ (Prasad and Sen 2010) critiques suggest for paying more attention to alternate knowledge systems of crop production which hitherto were discarded or rubbished under the positivist paradigm.

### **Take of social sciences**

At a broader level the issue of agrarian crisis has attracted the critical gaze of social scientists (Jodhka 2012; Vasavi 2012) while scholarship within the agricultural institutions chose to ignore it. Social scientists’ engagement with the vagaries of agriculture in the present context has largely been reactive and technological deterministic. The technological deterministic accounts view crop sciences from a black-box approach. From the point of a science technology and society studies perspective (MacKenzie and Wajcman 1999) critical examination of the social, cultural, economic and political forces guiding the scientific practices, assumptions and in all the cultural configuration of science yields significant relevant results. Deciphering the technological frame (Bijker 1995), the shared cognitive frame, which influence the institutional as well as individual approach to crop sciences helps in arriving at meaningful conclusions on the role of crop science in the agrarian crisis in the country.

Unfortunately the ‘statist’ discourse on agrarian crisis is so engaged with neoliberal policies that it ignored the science of agriculture. The neo-liberal framework to explain agrarian crisis becomes problematic as it fails to account for the institution of crop science. An attempt to problematize crop sciences was made by Lata Jishnu and Jyotika Sood in their reflective article ‘Science under siege’ in *Down to Earth* (Oct 31, 2013). In its attempt at understanding Indian agrarian crisis, witnessed in the form of farmers’ suicides, whose number is placed at 2,85,000, the article blames bureaucratic rigidities of the national research system. They argue that ‘agricultural science has ossified in India’. It highlights the problems of agricultural research in the country such as lack of original thinking and encouragement for out-of-the-box ideas for problem solving, self-defeating

exercise of prioritization of institutional research in terms of budget allocation, inefficient bureaucracy, and so on.

## **Chapter-III**

### **Crop science research in India: perceptions of agricultural scientists**

Scientific understanding of the causal factors of productivity in crops and efficiency of crop management enabled increasing yields significantly. The standardized practices of crop production have been translated into package of practices and conveyed to farmers. The entire exercise of developing the deliverable technologies has been taking place in the institutions of crop sciences established by the ICAR and other state funded institutions in the country. It may be mentioned that agricultural research in the country has been the monopoly of the state and any deliverable technologies must be coming out from the state agricultural research stations or universities. Even if any technology is developed outside these institutions it must be duly approved by the state funded agricultural research institutions. A technology thus approved finds place in the state extension agenda and has a scope for receiving funds for further research.

What is important to note is that the state institutions of crop science have greater control over the knowledge produced and disseminated in the country. In other words, these institutions have become the centres for certifying knowledge without whose appraisal and approval any innovative technology would not find place in the state's extension and research agenda. In this context it is important to understand what the scientific community thinks about the current agriculture scenario in the country, apart from agricultural science and its problems. Sociologically speaking, the attitudes, interests and meanings held by scientists get translated into research problems. Hence, the research problems scientists pursue is an outcome of their understanding of the social world and the research questions they raise reflect their interests.

Research is a social process. Social factors influencing the research objectives is quite apparent even in sciences. Agriculture science is one such broad field which has a bearing on the millions of farm families, especially the poor farmers. Thus, the kind of research questions the scientists evolve for research has an impact on the lives of millions of farm families. The present study aims to understand the social aspects of agricultural research in the country through a survey. The survey was conducted using a questionnaire consisting of statements intended to measure perceptions of scientists was developed and pre-tested. This chapter presents the findings from the data collected from scientists across

India. It gives the brief profile of scientists who responded to the questionnaire, followed by their reflections on several fields of observation incorporated in the survey questionnaire.

### **Institutional affiliation of the respondents**

The researcher approached the scientists in the state agricultural universities across the country. The scientists were met personally in their office during office hours. The intent of the research study was conveyed and the questionnaire was handed over to those who were willing to respond. A large majority of the scientists who were approached were enthusiastic to complete the questionnaire. In all, eighteen institutions of agriculture research spread over the country were visited. The states covered under the study are Telangana, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala, Delhi, Punjab, Assam, Uttaranchal and Maharashtra. All the southern states were covered while one state each from west and east parts of the country were covered.

Following is the list of institutions covered and the number of scientists who responded to the survey questionnaire. It may be found that out of 193 scientists who completed the questionnaire about 16 percent belong to Tamil Nadu agricultural university, Coimbatore followed by about nine percent from Professor Jayashankar Telangana State Agricultural University, Hyderabad, about eight percent from Acharya NG Ranga Agricultural University, Bapatla. Majority of the scientists are located in state agricultural universities while some respondents also belong to central research institutes also. The respondents include 145 men and 48 women scientists.

Table 1: Institution wise distribution of respondents

Name of the institution	No. of respondents	Percent
Tamil Nadu Agricultural University, Coimbatore	31	16.1
Professor Jayashankar Telangana State Agricultural University, Hyderabad	18	9.3
Acharya NG Ranga Agricultural University, Bapatla	16	8.3
Indian Agricultural Research Institute, New Delhi	15	7.8
GB Pant University of Agriculture and Technology, Pantnagar	14	7.3
Tamil Nadu Agricultural University, Madurai	14	7.3
Banaras Hindu University, Varanasi	12	6.2
Punjab Agricultural University, Ludhiana	12	6.2
Mahatma Phule Krishi Vidyapeeth Rahuri, Maharashtra	11	5.7
University of Agricultural Sciences, Bengaluru	11	5.7
Assam Agricultural University, Jorhat	10	5.2
Sri Venkateswara Agricultural College, Tirupati	10	5.2
Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar	9	5
Indian Institute of Millets Research, Hyderabad	7	3.6
Indian Council for Agricultural Research, New Delhi	2	1.0
Central Plantation Crops Research Institute , Kasargod, Kerala	1	.5
Total	193	100.0

Fig. 1: Institution wise distribution of respondents

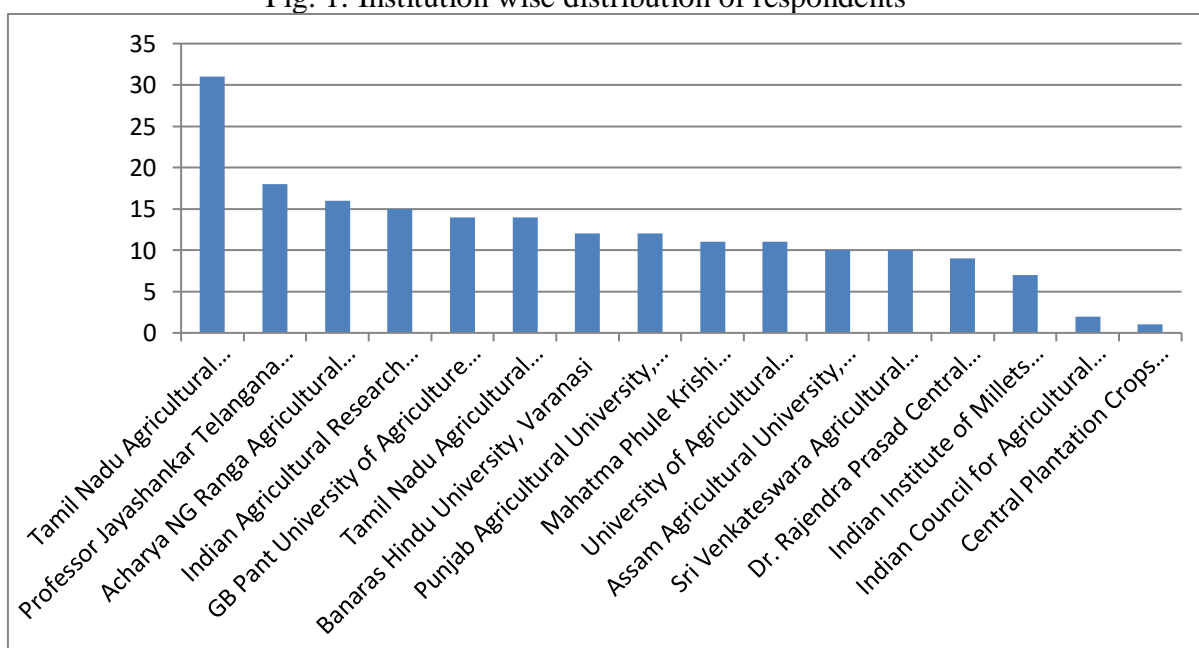
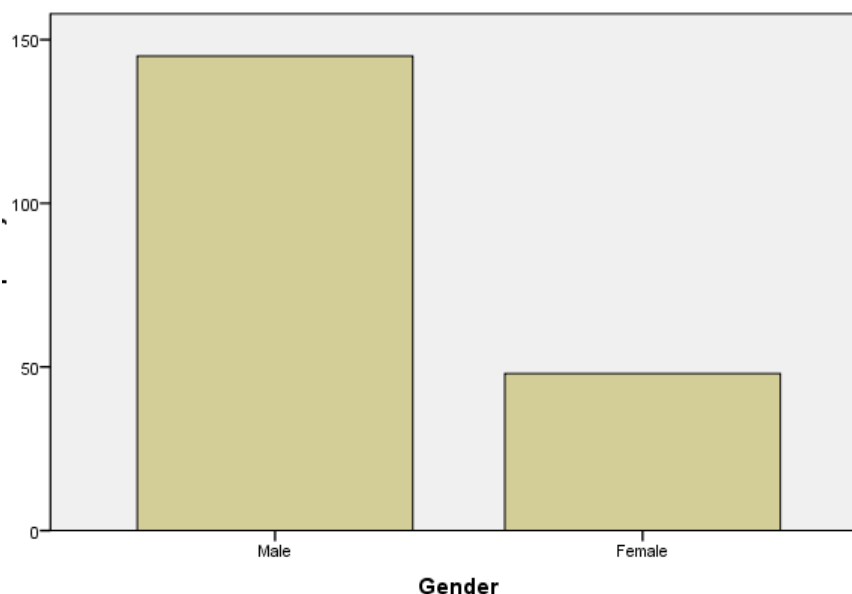


Table 2: Gender profile of respondents

Gender	No. of respondents	Percent
Men	145	75.1
Women	48	24.9
Total	193	100.0

Fig. 2: Gender profile of respondents



### Educational profile of respondents

Data on educational qualifications of the respondents reveal that a large number (about 97 percent) of them hold doctorate degree. There are only three respondents with post graduation qualification and two have a Post doctoral degree (see Table 3). About 54 percent (105 respondents) are in the rank of Professor (including Director of institute) and about 18 percent i.e. 35 respondents in the rank of Assistant Professor. Seventeen respondents are Principal Scientists, fourteen are Associate Professors and thirteen are Scientists. Nine respondents are in the rank of Senior Scientist (see Table 4).

Table 3: Educational Qualifications

Educational qualification	No. of respondents	Percent
Ph.D.	188	97.4
M.Sc.	3	1.6
Post Doctoral Fellow	2	1.0
Total	193	100.0

Fig. 3: Educational Qualifications

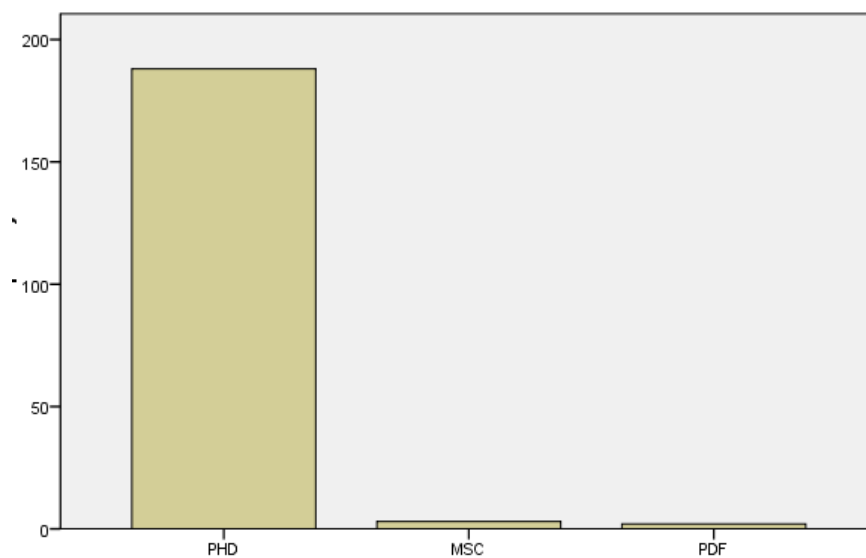
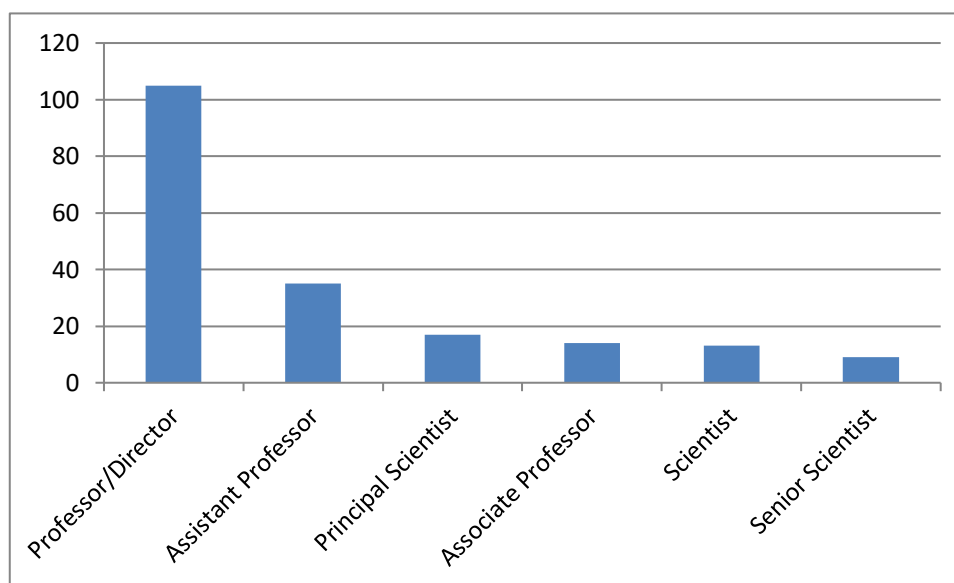


Table 4: Designation

Designation	No. of respondents	Percent
Professor/Director	105	54
Assistant Professor	35	18
Principal Scientist	17	9
Associate Professor	14	7
Scientist	13	7
Senior Scientist	9	5
Total	193	100.0

Fig. 4: Designation



About 49 percent (92 respondents) of the respondents have more than 21 years of experience followed by 38 percent (71 respondents) having eleven to twenty years of experience (see Table 5). As regards the experience in the present position, thirteen respondents (about seven percent) have more than 16 years of experience while about 36 percent have less than five of experience. About 57 percent of the respondents (105 respondents) have six to fifteen years of experience in the present job (see Table 6).

Table 5: Years of service

Years of service	No. of respondents	Percent
Less than 5 years	8	4.3
6 - 10 years	17	9.0
11 – 15 years	43	22.9
16 - 20 years	28	14.9
21 years and above	92	48.9
Total	188	100.0

Fig. 5: Years of service

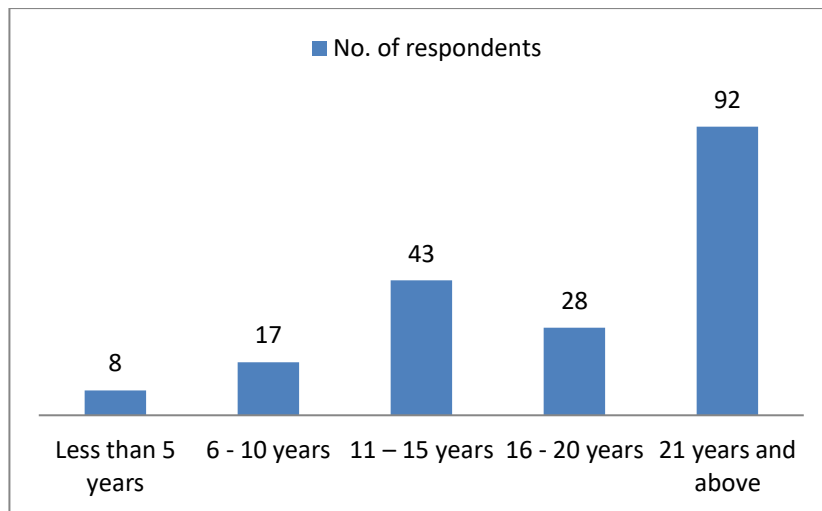
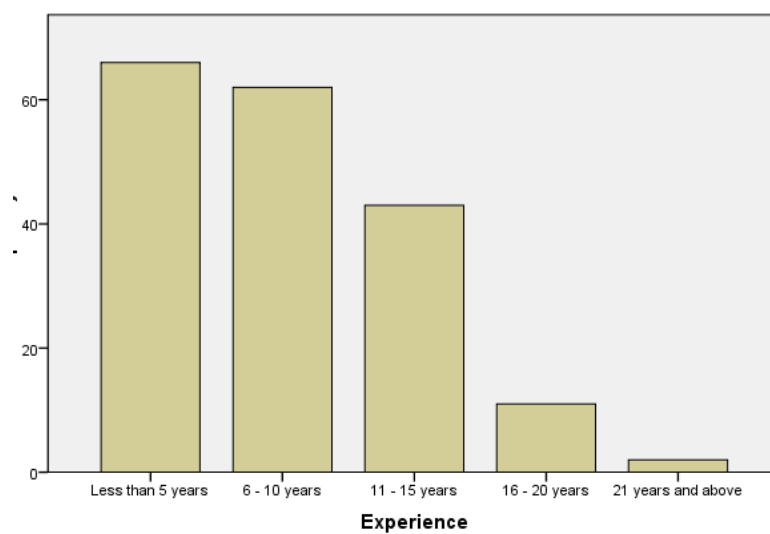


Table 6: Experience in the present position

Experience in the present position (in years)	No. of respondents	Percent
Less than 5 years	66	36
6 - 10 years	62	34
11 - 15 years	43	23
16 - 20 years	11	6
21 years and above	2	1
Total	184	100.0

Fig. 6: Experience in the present position



## Specialization

Agriculture science is a vast field covering a wide variety of specializations related to crop production. What has begun with fields like soil chemistry and crop physiology in the beginning of the emergence of agricultural sciences the specializations now include even computer science, business management, statistics, etc. However, data were collected from the scientists located in departments like agronomy, plant breeding, entomology, pathology, extension, etc. with the assumption that these specializations have a direct bearing on crop cultivation and thus on the farmer. The research questions the scientists located in these departments raise and the outcomes of their research have a direct impact on farmer. As regards other specializations, they are essential part of modern agriculture science but play a supporting role.

Table 7: Specialization

Department	No. of respondents	Percent
Agronomy	62	33
Plant Breeding	39	20
Entomology	35	18
Plant Pathology	26	14
Agriculture Extension	18	9
Agricultural Economics	11	6
Total	191	100.0

Out of 191 scientists who responded to the question on the specialization about 33 percent are working in Agronomy department followed by Plant Breeding (about 20 percent), Entomology (about 18 percent) and Plant Pathology (about 14 percent). Data were also collected from scientists working in Agricultural Extension and Agricultural Economics. The scientists who responded to the survey were not chosen using random sampling procedures. Rather the researcher adopted purposive sampling procedure and approached scientists working in these six divisions. These six divisions were arrived at based on the understanding that scientists in these divisions work on problems directly related to farmers at field level.

Fig. 7: Specialization

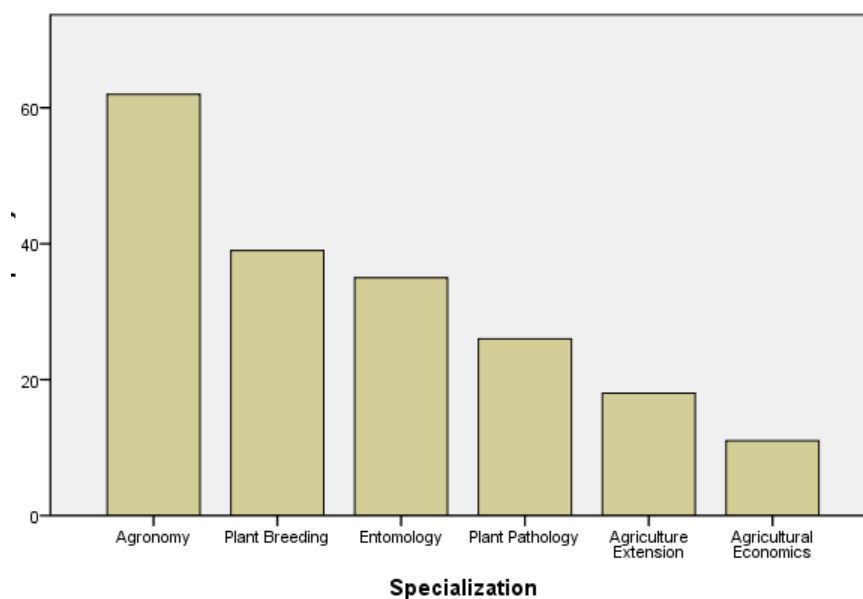


Table 8: Gender and specialization

Specialization	Gender		Total
	Women	Men	
Agronomy	14	48	62
Plant Breeding	12	27	39
Entomology	7	28	35
Plant Pathology	7	19	26
Agriculture Extension	3	15	18
Agricultural Economics	5	6	11
Total	48	143	191

Data on gender and specialization reveal that majority of the women respondents belong to Agronomy division followed by Plant breeding. The trend is similar to that of men scientists. It needs to be mentioned that this data is not indicative of any trend on gender and specializations as the respondents were not chosen using random sampling procedure.

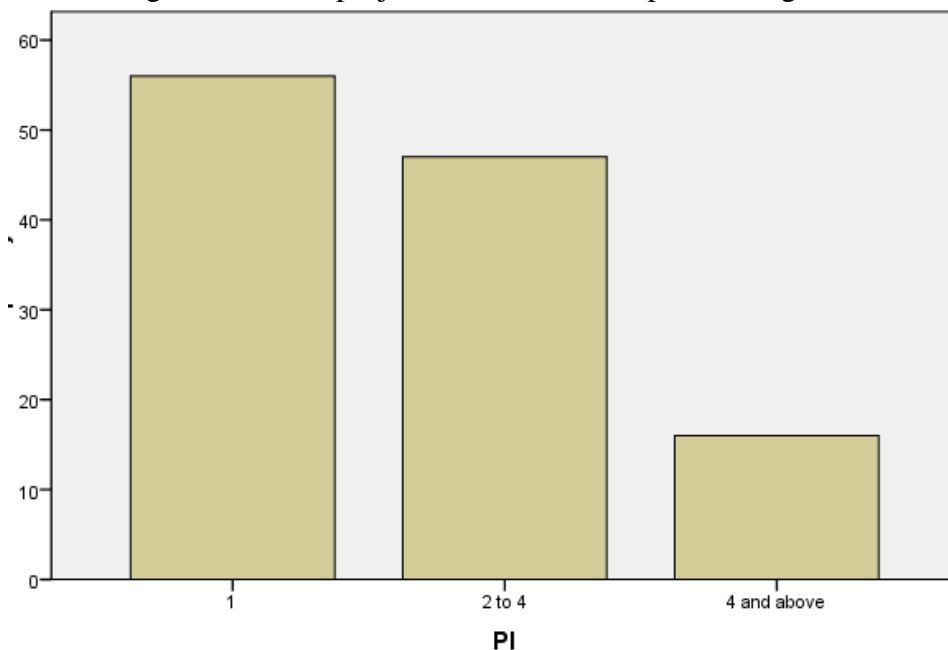
## Research

Research is an integral part of scientists' work in agricultural institutes. It is an intensive affair and the scientists strive to contribute to the pool of knowledge to their disciplinary domains by engaging in research. The funding for research is provided to individual scientists as well as group projects. Coordinated projects are essential part of agriculture research system in India wherein scientists located in different parts of the country work on similar research problems. The present study intending to know the intensity of involvement of scientists in research collected data on the number of projects the respondents are currently engaged in. Table 9 suggests that about 47 percent of the respondents are handling one project as Principal Investigator and about 40 percent of them are handling two to four projects. About 13 percent are handling more than four research projects.

Table 9: Research projects handled – Principal Investigator

Principal Investigator	No. of respondents	Percent
One Research Project	56	47
2 to 4 Research Projects	47	40
4 Research Projects and above	16	13
Total	119	100.0

Fig. 8: Research projects handled –Principal Investigator

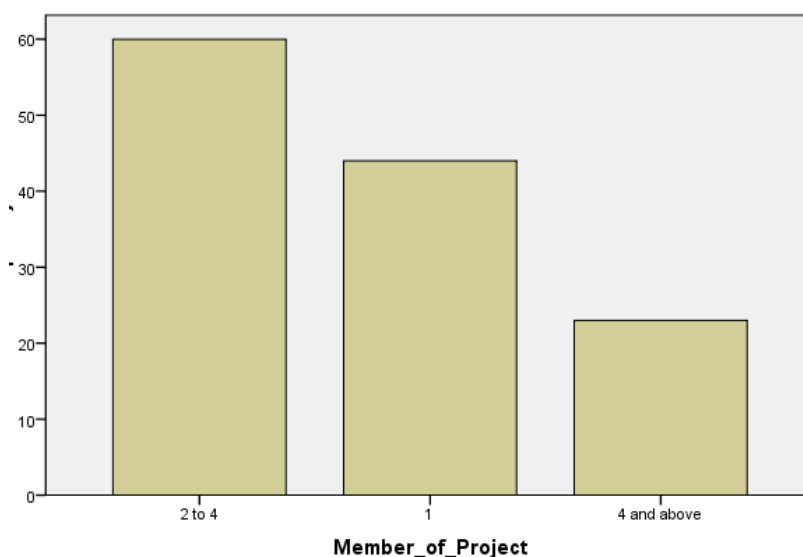


Similarly, about 47 percent are engaged in two to four research projects as a member of the larger group. In all, about 65 percent of the respondents are part of more than two research project teams. Only about 35 percent are part of one research project team.

Table 10: Research projects handled – Member of a project team

Member of Research Project	No. of respondents	Percent
One Research Project	44	35
2 to 4 Research Projects	60	47
4 Research Projects and above	23	18
Total	127	100.0

Fig. 9: Research projects handled – Member of a project team



## Research areas

Data on the areas of research the scientists were currently engaged with was collected to know the broad fields the scientists have chosen to work. This question was framed considering the fact that scientists pursue research in the areas of their interest which are arrived at based on their conviction irrespective of the factors like institutions' mandate, funding agency's requirement, etc. During personal interaction, scientists

reported that the institution's mandate is primary and they are supposed to carry out projects in the thrust areas of institution which they call as 'institution's mandate'. Data reveal that a majority of the research projects are related to entomology, plant breeding, crop production, climate change, etc. A large majority of the scientists are working on issues related to pest management, agronomy, molecular biology, etc. It was also be found that scientists are taking up issues related to crop insurance, marketing, climate change, etc. which have greater implications for agriculture in the country in the years to come.

### **List of research areas**

- Entomology: Host plant resistance to insect pests, Management of insect pests, Storage insect pests, Eco- friendly Pest management, Economic entomology, IPM, Soybean and cabbage Entomology, Economic entomology, Biological control of insect pests, Identification of Nematodes, Entomopathogen
- Plant breeding for stress tolerance, Mutation breeding
- Organic farming, organic certification
- Soil conservation and management
- Molecular biology, Genomics for disease resistance, Germplasm conservation, Genetic engineering, Isolation of bio control agents, Molecular diagnostics
- Disease resistance in field crops
- Epidemiology and Forecast
- Climate change, biodiversity, Conservation agriculture
- Crop Insurance
- Agronomy: Abiotic stress physiology, Abiotic stress tolerance
- Crop production (rice, wheat, maize, cotton, chick pea, pulses, cucumber, groundnut, spices, papaya, etc), Crop improvement, Crop nutrition, Crop Physiology, Seed storage, Host-pathogen interaction, Host-virus-vector interaction
- Weed Management and Yield, Solid waste management, Water management, Drought tolerance
- Low cost sensor development
- Fodder production
- Nanotechnology
- Marketing, Communication and Transfer of Agricultural Technologies, Knowledge adoption

### **Inspiration for research problem**

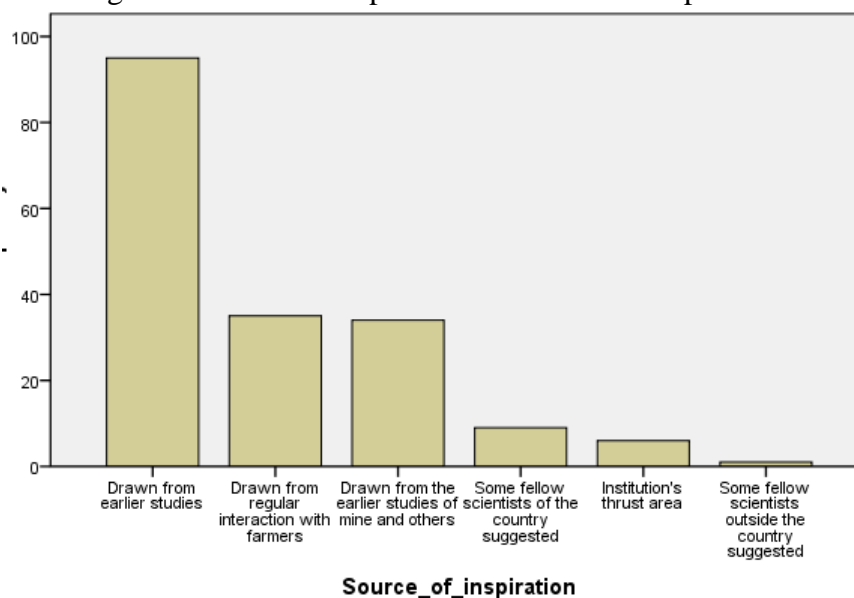
Over the years, agriculture science emerged as a scientific discipline and scientists engage in such research which fulfils their career goals as well as societal needs. The present study, intending to know the perceptions of scientists on the sources of inspiration, a set of statements were prepared and the scientists were asked to respond appropriately. Data reveal that about 53 percent of the respondents mentioned that they draw inspiration for research from the earlier studies in their domain. Only about 19 percent reported to

have received inspiration from interaction with farmers. This reveals that scientists are working on research problems which are important from the academic point of view. However, this does not rule out the possibility that the academic concerns do not match with farmers' concerns.

Table 11: Sources of inspiration for the research problem

Sources of inspiration for drawing research problem currently handled by the scientists	No. of respondents	Percent
Drawn from earlier studies	95	53
Drawn from regular interaction with farmers	35	19
Drawn from the earlier studies of mine and others	34	19
Some fellow scientists of the country suggested	9	5
Institution's thrust area	6	3
Some fellow scientists outside the country suggested	1	1
Total	180	100.0

Fig. 10: Sources of inspiration for the research problem



## Identification of research areas

The importance of the question on research areas is not just about the broad fields of research in which scientists are working but with the source of motivation for identification of such areas of research. Agriculture science being application oriented and problem solving in nature inspires researchers to focus on research areas which are the need of the hour for farmers and other stakeholders of crop production. Intending to know how the research areas are identified a set of statements were incorporated in the questionnaire and the scientists were asked to respond to these statements. The opinion was measured on a continuum ranging from strongly agree to strongly disagree.

Out of 182 respondents about 77 percent agreed with the statement that scientists arrive at research problem based on their conviction (see Table 12). About 81 percent (out of 182 respondents) agreed to the statement that institution plays a significant role in identifying the research areas (see Table 13). Similarly about 68 percent (out of 182 respondents) agreed to the statement that government priorities play an important role in deciding the research area (see Table 14). Interestingly only about 39 percent (out of 182 respondents) reported that industry's concern play an important role in arriving at research problem (see Table 15). Out of 185 scientists 173 respondents (about 94 percent) agreed that farmers' concerns play a significant role in identifying the research areas (see Table 16). Responding to the statement that research problems are influenced by the priorities of the funding agencies about 62 percent (out of 185 respondents) agreed while 14 percent disagreed (see Table 17).

Table 12: Factors influencing the selection of research topics – Conviction of the scientist

Arrive at the research problem based on my conviction	No. of respondents	Percent
Strongly Agree	62	34
Agree	79	43
Disagree	15	8
Strongly Disagree	3	2
Can't say	13	7
NR	10	6
Total	182	100.0

Fig. 11: Factors influencing the selection of research topics – Conviction of the scientist

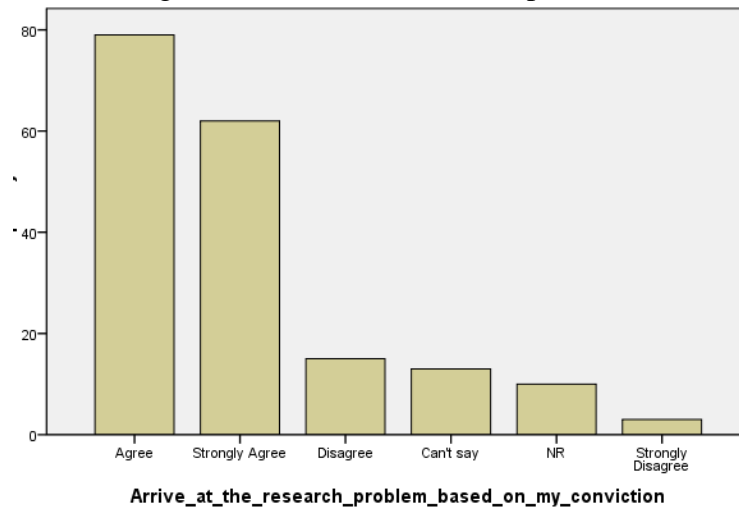


Table 13: Factors influencing the selection of research topics – Institution

Institution plays an important role	No. of respondents	Percent
Strongly Agree	48	26.4
Agree	100	54.9
Disagree	10	5.5
Strongly Disagree	2	1.1
NR	5	2.7
Can't say	17	9.3
Total	182	100.0

Fig. 12: Factors influencing the selection of research topics – Institution

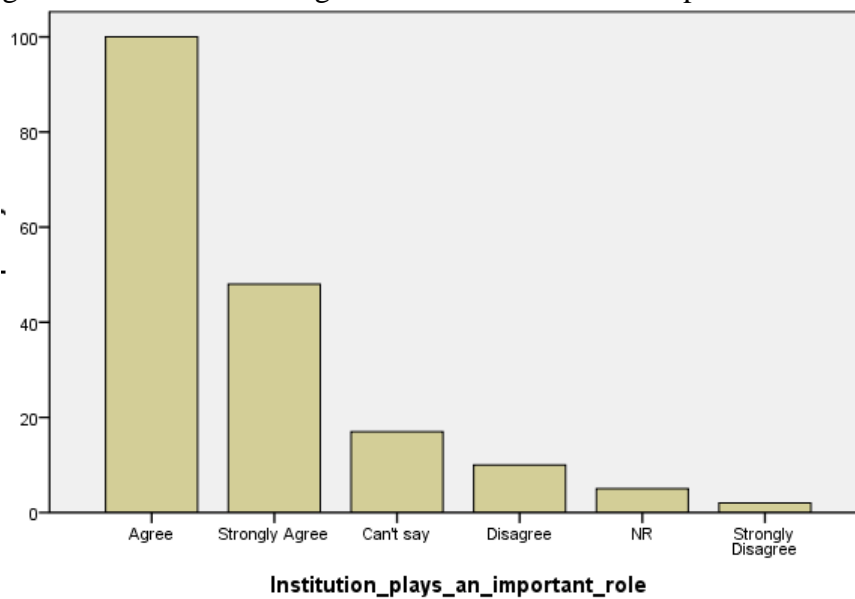


Table 14: Factors influencing the selection of research topics – Government priorities

Government priorities play an important role	No. of respondents	Percent
Agree	95	52.2
Strongly Agree	29	15.9
Disagree	18	9.9
Strongly Disagree	1	.5
NR	9	4.9
Can't say	30	16.5
Total	182	100.0

Fig. 13: Factors influencing the selection of research topics – Government priorities

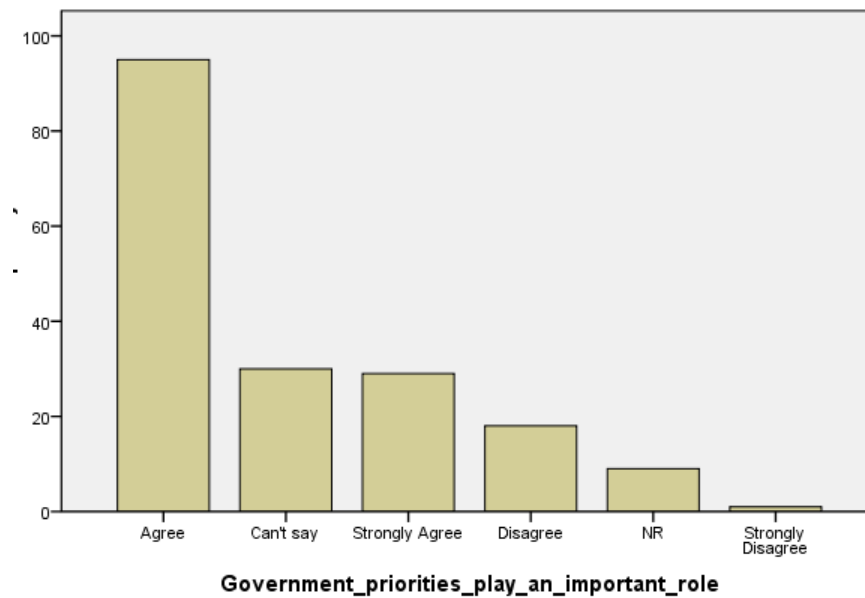


Table 15: Factors influencing the selection of research topics – Concerns of the industry

Concerns of the Industry	No. of respondents	Percent
Strongly Agree	19	10.4
Agree	52	28.6
Disagree	31	17.0
Strongly Disagree	13	7.1
NR	15	8.2
Can't say	52	28.6
Total	182	100.0

Fig. 14: Factors influencing the selection of research topics – Concerns of the industry

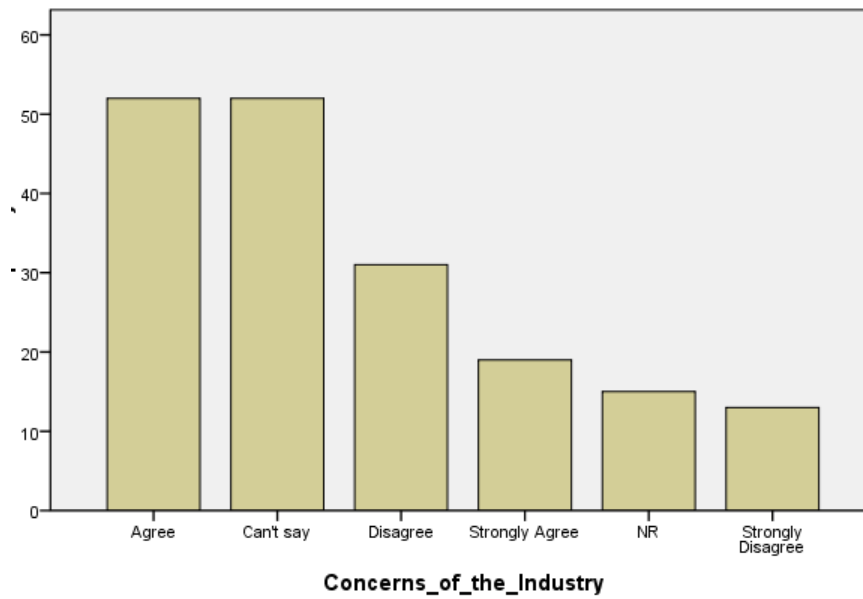


Table 16: Factors influencing the selection of research topics – Farmers’ concerns

Farmers’ concerns	No. of respondents	Percent
Strongly Agree	119	64.3
Agree	54	29.2
Disagree	1	.5
Strongly Disagree	1	.5
Can't say	7	3.8
NR	3	1.6
Total	185	100.0

Fig. 15: Factors influencing the selection of research topics – Farmers’ concerns

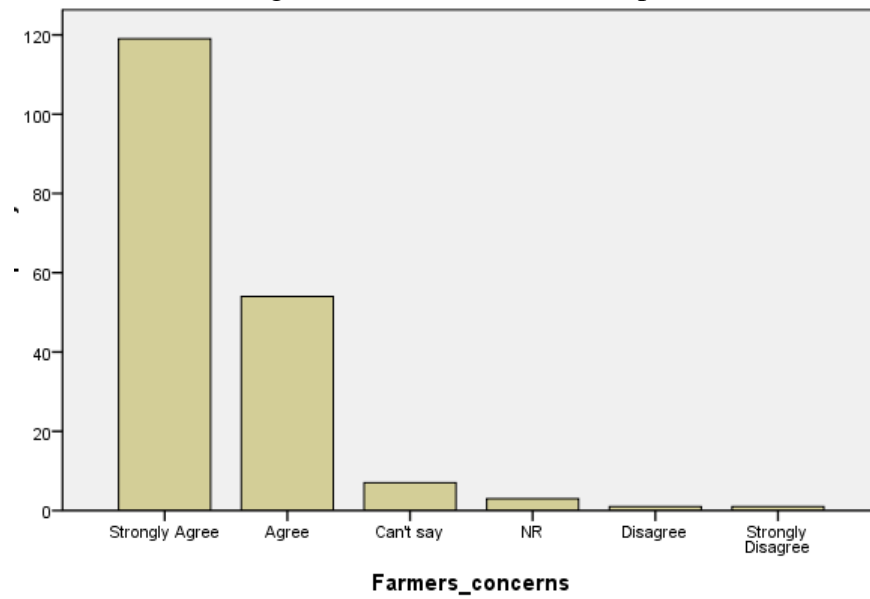


Table 17: Factors influencing the selection of research topics – Funding agency priorities

Priorities of the funding agencies	No. of respondents	Percent
Strongly Agree	32	17.3
Agree	83	44.9
Disagree	20	10.8
Strongly Disagree	6	3.2
Can't say	31	16.8
NR	13	7.0
Total	185	100.0

Fig. 16: Factors influencing the selection of research topics – Funding agency priorities

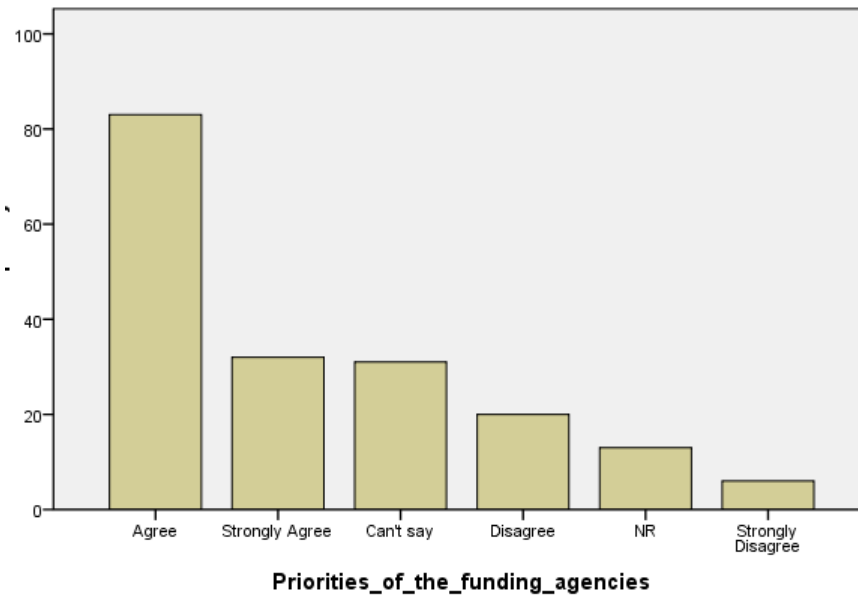
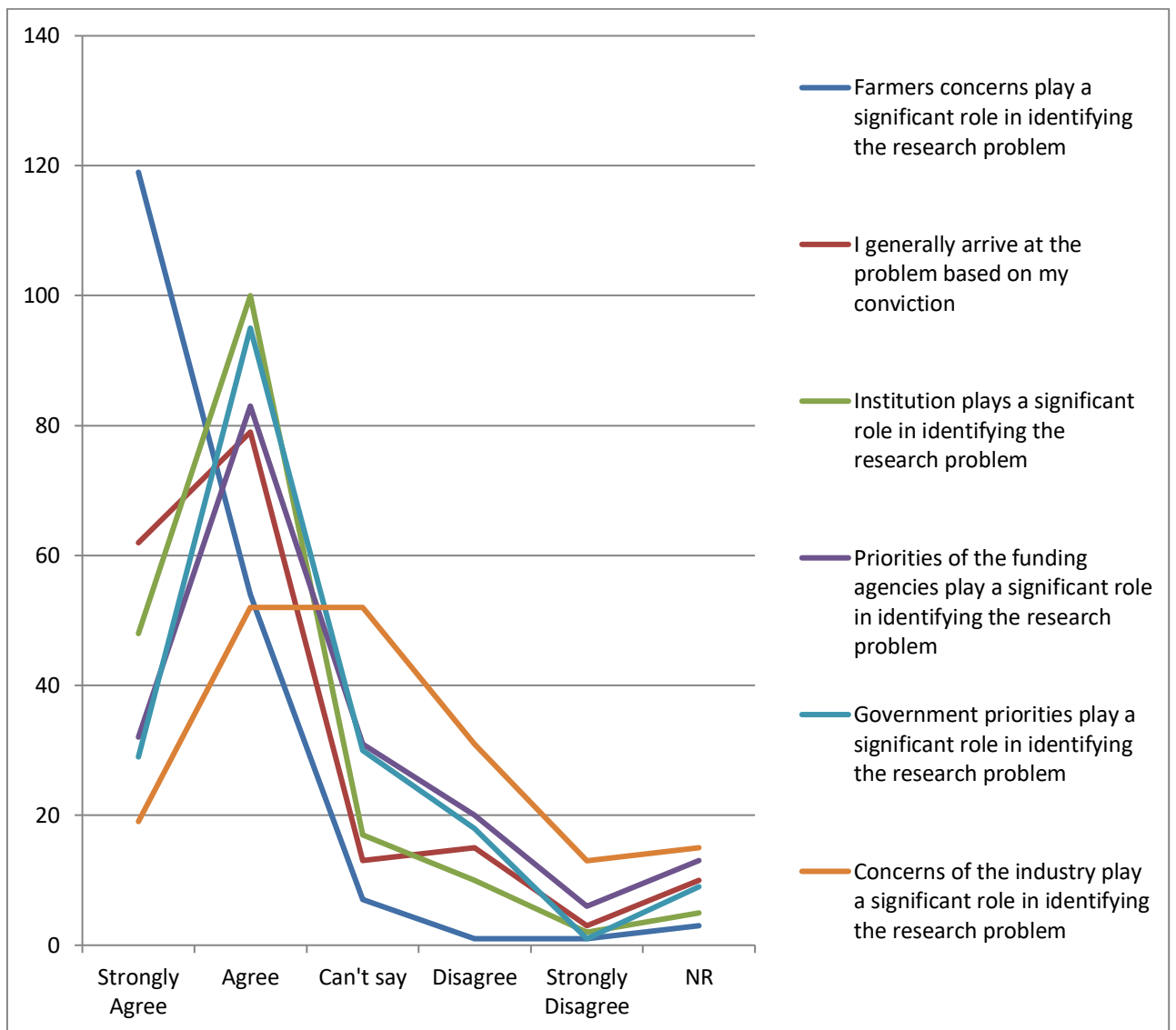


Table 18: Factors influencing the selection of research topics

Factors influencing the identification of research areas and sub areas	Strongly Agree	Agree	Disagree	Strongly Disagree	Can't say	NR	Total
Farmers' concerns play a significant role in identifying the research problem	119	54	1	1	7	3	185
I generally arrive at the problem based on my conviction	62	79	15	3	13	10	182
Institution plays a significant role in identifying the research problem	48	100	10	2	17	5	182
Priorities of the funding agencies play a significant role in identifying the research problem	32	83	20	6	31	13	185
Government priorities play a significant role in identifying the research problem	29	95	18	1	30	9	182
Concerns of the industry play a significant role in identifying the research problem	19	52	31	13	52	15	182

Fig. 17: Factors influencing the selection of research topics



### Formulating research questions

Continuing the inquiry on how scientists arrive at research problems and the sources they depend on for formulating research questions a set of three statements was given and the scientists were asked to respond. The responses were elicited in the form of agreement on a five point continuum ranging from strongly agree to strongly disagree. Data finds that out of 189 scientists who responded about 94 percent agreed to the statement that they draw inspiration from the questions encountered in the field (see Table 20). About 78 percent reported to have drawn inspiration from gaps in the present literature corroborating the response on sources of inspiration (Table 11) in which the respondents suggested that they draw inspiration for research from the earlier studies in

their domain (see Table 19). Another important observation is that about 75 percent of the respondents are in agreement with the statement that they draw inspiration for research from market as the one that has potential for commercial application (see Table 21). In a way this response contradicts the earlier response on the statement about factors influencing the selection of research topics and the role of industry. Responding to this statement about 61 percent were in disagreement (refer Table 15). If it is assumed that industry's concerns are about gaining market advantage through research, then the scientists had reported to be in disagreement with one statement while they tend to have greater interest in commercial applicability of their research.

Table 19: Sources of research questions – Gaps in the literature

Gaps in the literature	No. of respondents	Percent
Strongly Agree	55	29.1
Agree	92	48.7
Disagree	6	3.2
Can't say	19	10.1
NR	17	9.0
Total	189	100.0

Fig. 18: Sources of research questions – Gaps in the literature

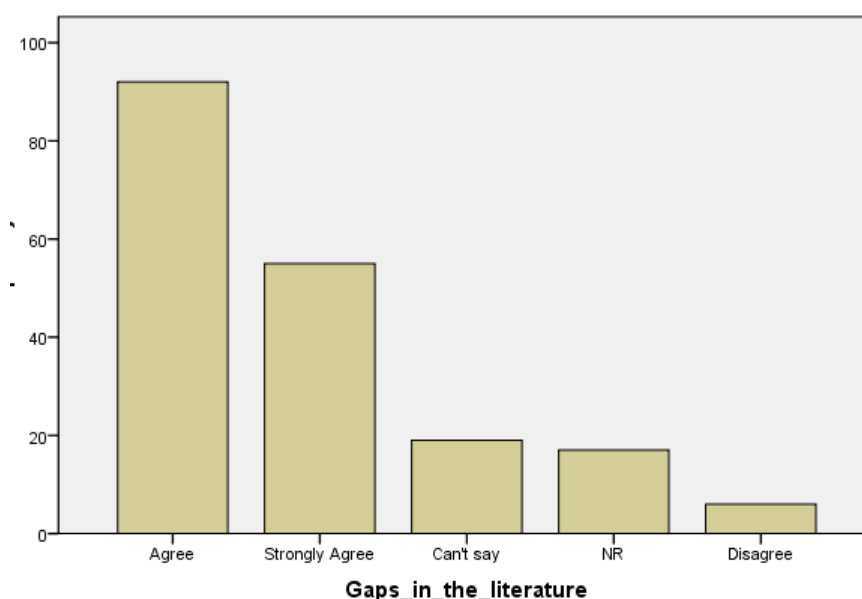


Table 20: Sources of research questions – Questions encountered in the field

Questions encountered in the field	No. of respondents	Percent
Strongly Agree	97	51.3
Agree	80	42.3
Disagree	3	1.6
Can't say	5	2.6
NR	4	2.1
Total	189	100.0

Fig. 19: Sources of research questions – Questions encountered in the field

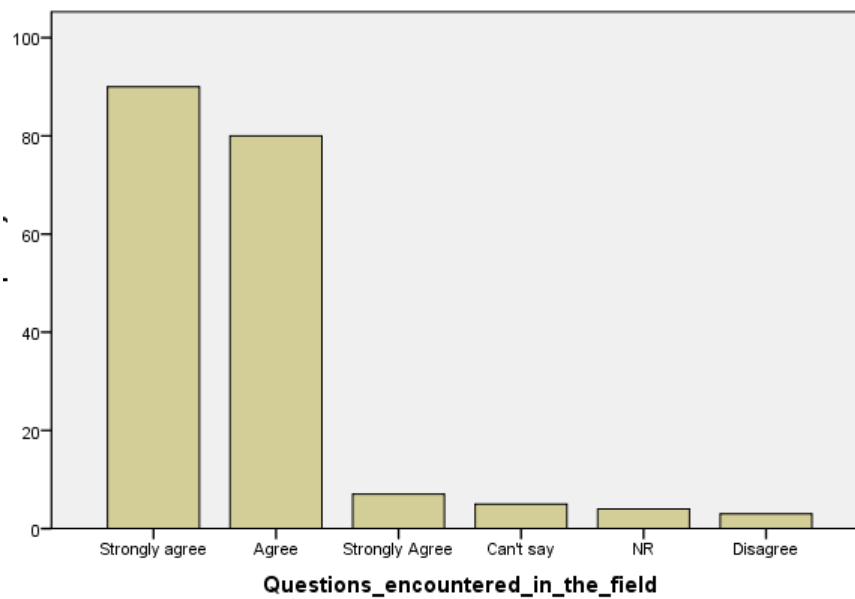


Table 21: Sources of research questions – Potential for commercial application

Potential for commercial application	No. of respondents	Percent
Strongly Agree	56	29.6
Agree	85	45.0
Disagree	10	5.3
Strongly Disagree	5	2.6
Can't Say	23	12.2
NR	10	5.3
Total	189	100.0

Fig. 20: Sources of research questions – Potential for commercial application

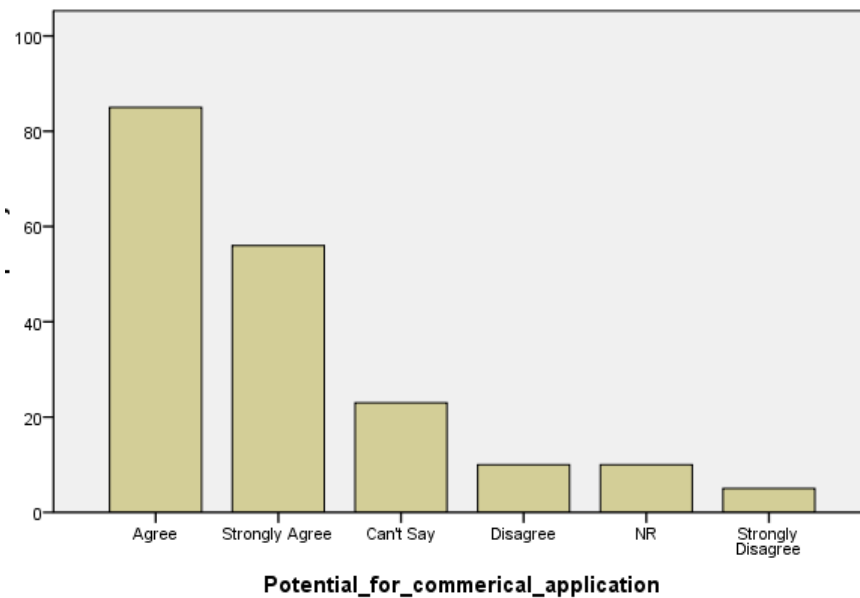


Table 22: Sources of research questions

Influence of the following sources for arriving at research problem	Strongly Agree	Agree	Can't Say	Disagree	Strongly Disagree	NR
Gaps in the present literature	55	92	19	6	-	17
Questions encountered in the field	90	80	5	3	7	4
Potential for commercial application	56	85	23	10	5	10
						Total 189

## **Formulating research objectives**

Agricultural science focuses on research that helps farmers and nation to overcome challenges of several kinds in crop production. It has larger goals of serving the food needs of the country. Green revolution era agricultural science research closely followed the needs of the farmers, gaps and challenges in cultivation and developed research outcomes. It is a known fact that with these efforts India could overcome the problem of food shortage in a very short span and emerged as the exporter of food grains.

Post green revolution, the contemporary phase, is witnessing the emergence of new challenges for agriculture as well as for agriculture research in the country. Agricultural scientists face challenges of serving the interests of farmers, nation as well as their disciplines. It may be said that agriculture science as a specialization emerged as a discipline of its own within the ambit of plant sciences and it is difficult for the scientists to ignore the challenges posed by the discipline. Moreover, it is important to note that the agricultural scientists working in several research institutions lead a career that is marked by the typical standards of evaluation for promotion and career growth.

At the same time Indian farmers are passing through a difficult phase wherein cultivation became a poor man's option and that which no more supports a family to sustain. In this context the present study included a set of questions to ascertain the objectives scientists keep in mind while formulating the research problems. Intending to measure the perception of scientists towards the objectives of their research, the respondents were asked to rank a set of objectives, ranging from productivity to technology generation, in the order of their preference. Respondents were asked to prioritize six statements according to their choice of rank from 1 to 6, with 1 being the most preferred rank to 6 being the least preferred. This was aimed at arriving at the most preferred research objectives and the least preferred research objectives.

Table 23: Ranking of factors considered while formulating research objectives –  
Productivity

Productivity	No. of respondents	Percent
1	104	54.7
2	35	18.4
3	20	10.5
4	13	6.8
5	2	1.1
6	6	3.2
NR	10	5.3
Total	190	100.0

Table 23 suggests that about 55 percent of the respondents place productivity as the highest ranking objective in formulating the research proposal.

Fig. 21: Ranking of factors considered while formulating research objectives –  
Productivity

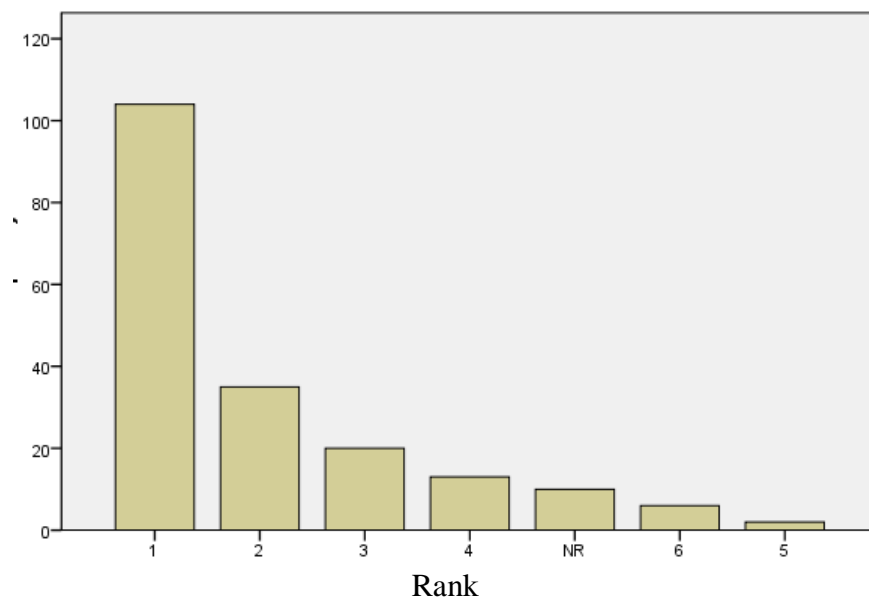


Table 24: Ranking of factors considered while formulating research objectives – Yield

<b>Yield</b>	<b>No. of respondents</b>	<b>Percent</b>
1	63	33.2
2	65	34.2
3	28	14.7
4	7	3.7
5	7	3.7
6	4	2.1
NR	16	8.4
Total	190	100

It may be ascertained from Table 24 that only about 33 percent of the respondents place yield as the highest ranking objective in formulating the research proposal.

Fig. 22: Ranking of factors considered while formulating research objectives – Yield

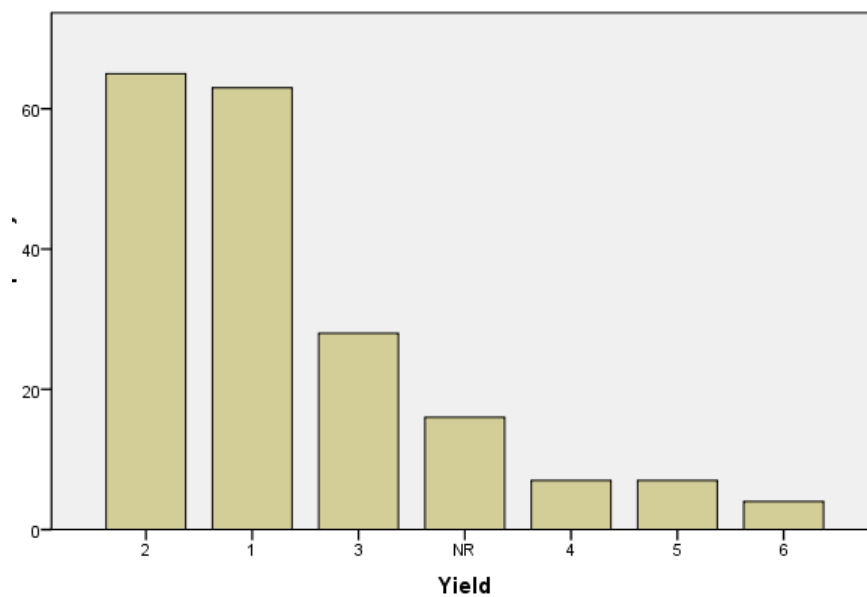


Table 25: Ranking of factors considered while formulating research objectives – Problem solving

Problem solving	No. of respondents	Percent
1	109	57.4
2	28	14.7
3	26	13.7
4	16	8.4
5	4	2.1
6	3	1.6
NR	4	2.1
Total	190	100.0

For about 57 percent respondents problem solving is the highest ranking objective while formulating their research proposal.

Fig. 23: Ranking of factors considered while formulating research objectives – Problem solving

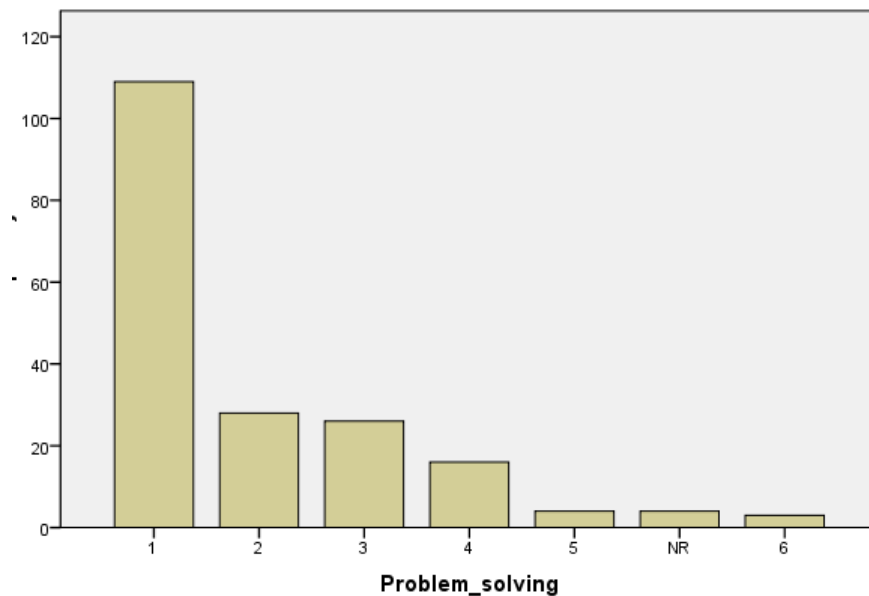


Table 26: Ranking of factors considered while formulating research objectives –  
Publications

Publications	No. of respondents	Percent
1	19	10.0
2	28	14.7
3	40	21.1
4	24	12.6
5	25	13.2
6	39	20.5
NR	15	7.9
Total	190	100.0

About 50 percent of the respondents (including the ranks 4, 5 and 6) do not consider publications as a high ranking objective kept in mind while preparing the research proposal. However, more than fifty five percent of the respondents (1, 2 and 3 ranks together) consider further research as an important factor while formulating the research objectives (see Table 27).

Fig. 24: Ranking of factors considered while formulating research objectives –  
Publications

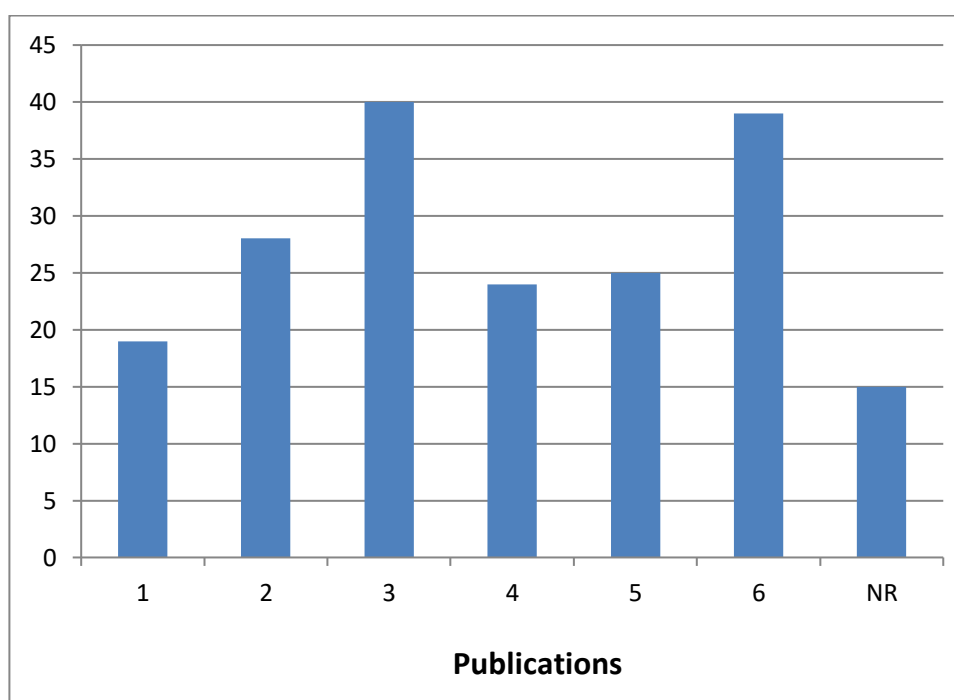


Table 27: Ranking of factors considered while formulating research objectives – Further research

Further research	No. of respondents	Percent
1	39	20.5
2	46	24.2
3	20	10.5
4	24	12.6
5	29	15.3
6	22	11.6
NR	10	5.3
Total	190	100.0

Fig. 25: Ranking of factors considered while formulating research objectives – Further research

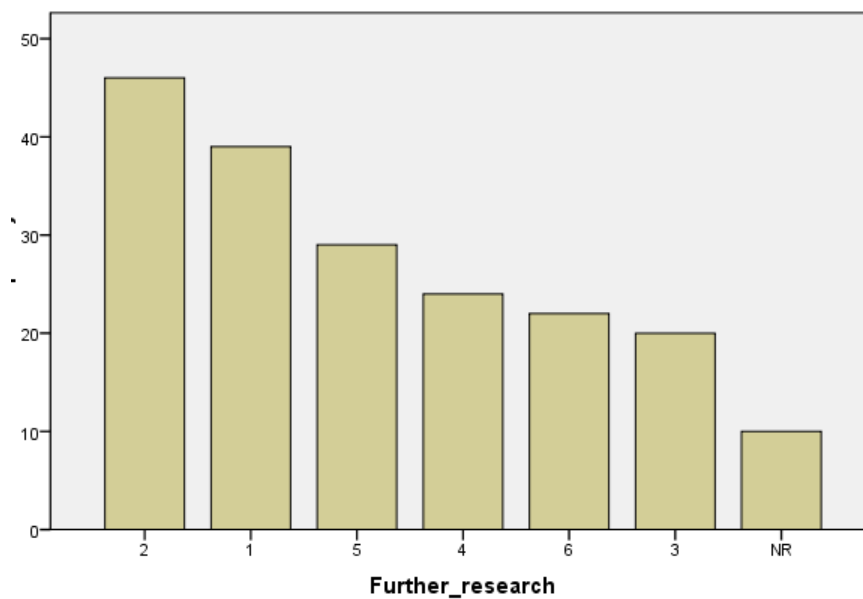
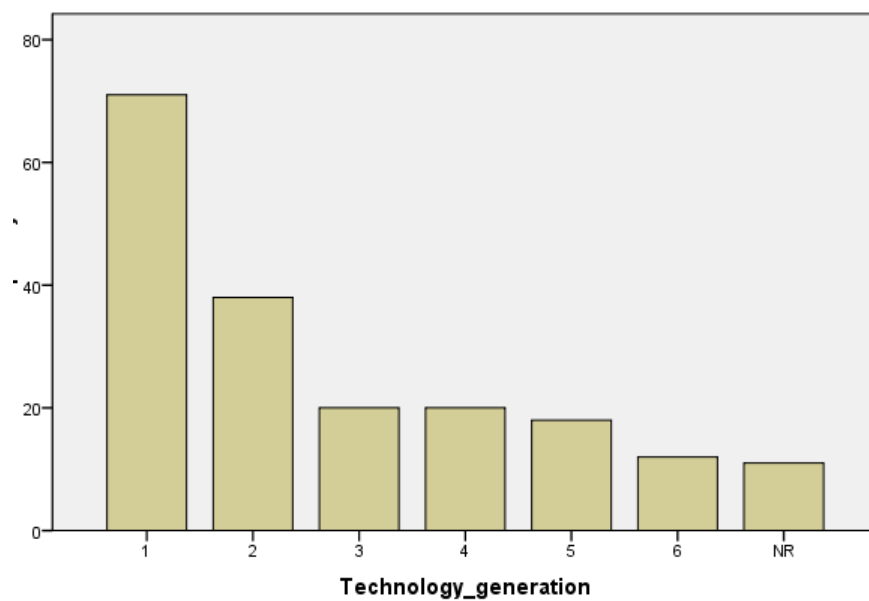


Table 28: Ranking of factors considered while formulating research objectives –  
Technology generation

Technology generation	No. of respondents	Percent
1	71	37.4
2	38	20.0
3	20	10.5
4	20	10.5
5	18	9.5
6	12	6.3
NR	11	5.8
Total	190	100.0

For about 37 percent of the respondents technology generation is an important factor to be considered while formulating the research objectives.

Fig. 26: Ranking of factors considered while formulating research objectives –  
Technology generation

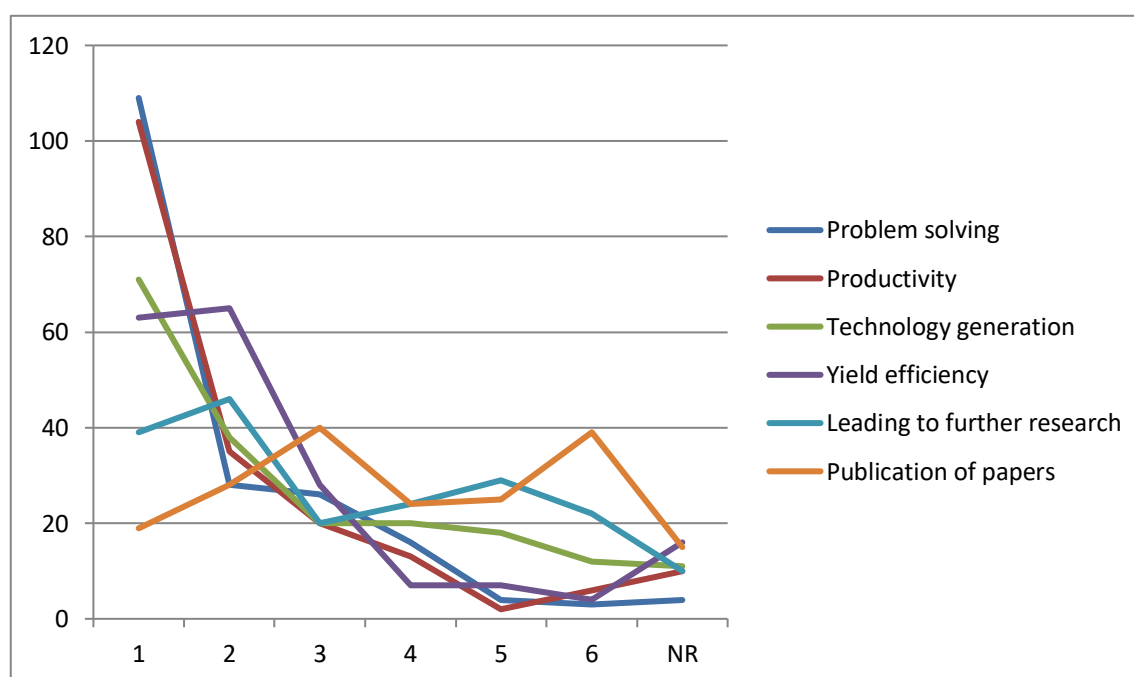


Among several objectives placed before the scientists problem solving emerged as the highest ranking objective considered while formulating the research objectives (see Table 29). Out of 190 respondents about 57 percent choose problem solving as the most preferred objective closely followed by productivity (about 55 percent). It is important to observe that for a significant number of respondents (about 46 percent) publication of papers through research is not a preferred objective.

Table 29: Ranking of factors considered while formulating research objectives

Broad objectives considered while formulating the research problem	1	2	3	4	5	6	NR
Problem solving	109	28	26	16	4	3	4
Productivity	104	35	20	13	2	6	10
Technology generation	71	38	20	20	18	12	11
Yield efficiency	63	65	28	7	7	4	16
Leading to further research	39	46	20	24	29	22	10
Publication of papers	19	28	40	24	25	39	15
N=190							

Fig. 27: Ranking of factors considered while formulating research objectives



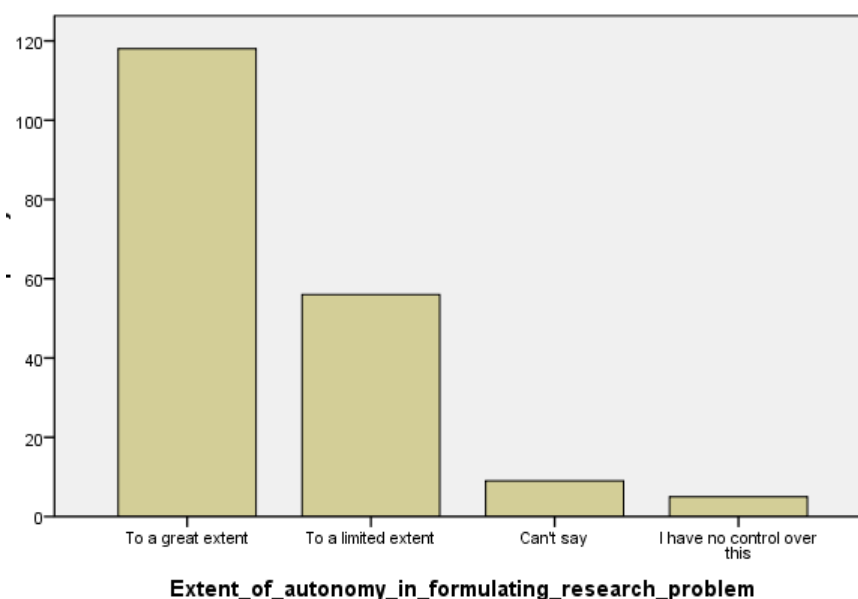
## Autonomy in research

Selection of research problem is influenced by both individual and institutional factors. Individuals specialized in disciplines choose a research problem which must be in tune with the institution's mandate of research. Sometimes individual researchers find exciting research problems within their discipline, which, however, doesn't suit the institution's mandate. In such situations the researcher has to modify, change and find a research problem accordingly. Autonomy refers to the possibility of getting funds for research topics of their choice. The extent of autonomy the scientists enjoy is reflected in the possibility of selecting a research problem of their choice. In this regard, the study collected data on the perceptions of scientists on the amount of autonomy they enjoy in selecting research problems. Data suggest that about 63 percent of the respondents felt that they enjoy autonomy in formulating research problems to a great extent (refer Table 30) while 30 percent felt the autonomy was limited.

Table 30: Extent of autonomy in formulating research problem

Extent of autonomy in formulating research problem	No. of respondents	Percent
To a great extent	118	62.8
To a limited extent	56	29.8
Can't say	9	4.8
I have no control over this	5	2.7
Total	188	100.0

Fig. 28: Extent of autonomy in formulating research problem



### Relevance of social and structural differentiation in agricultural research

The emerging agrarian scenario in the country is marked by the presence of persons engaged in cultivation belonging to lower strata of social hierarchy. The swelling numbers of dalit, OBC, ST and women farmers point towards the impending need to streamline and orient agricultural research to the needs of these sections of farmers. The science of crop production is founded upon the positivist epistemological framework which considers scientific findings as universal and valid in any given context with moderate scope for variations. However, in the emerging context the need for modifying the paradigm and revisiting the assumptions of farm and farmer with which the scientific community in agricultural research stations and universities work has become imperative.

In order to know the perceptions of scientists towards this emerging reality it was attempted to know whether they consider social differentiation (along the lines of SC, ST, OBC and women farmers), in terms of caste and gender as an essential part of the research process. Findings suggest that about 52 percent of respondents believe that this (social differentiation along caste and gender lines) is not relevant in the formulation of research problem while about 42 percent observed it to be relevant (including both relevant and most relevant, see Table 31).

About 51 percent of the respondents consider social differentiation is irrelevant in developing new technologies, while about 44 percent consider it relevant (see Table 32). In taking up collaborative research projects about 46 percent observed that social differentiation is relevant while 48 percent felt it irrelevant (see Table 33). With reference to developing new varieties about 56 percent felt that social differentiation is irrelevant while only about 34 percent felt it to be relevant (see Table 34). However, when it comes to field demonstrations majority of the respondents (about 54 percent) consider social differentiation is relevant while only about 38 percent felt it to be irrelevant (see Table 35).

Table 31: Extent of consideration of social differentiation in formulating the research problem

In the formulation of research problem	No. of respondents	Percent
Most Relevant	32	17.6
Relevant	45	24.7
Not Relevant	94	51.6
No Response	11	6.0
Total	182	100.0

Fig. 29: Extent of consideration of social differentiation in formulating the research problem

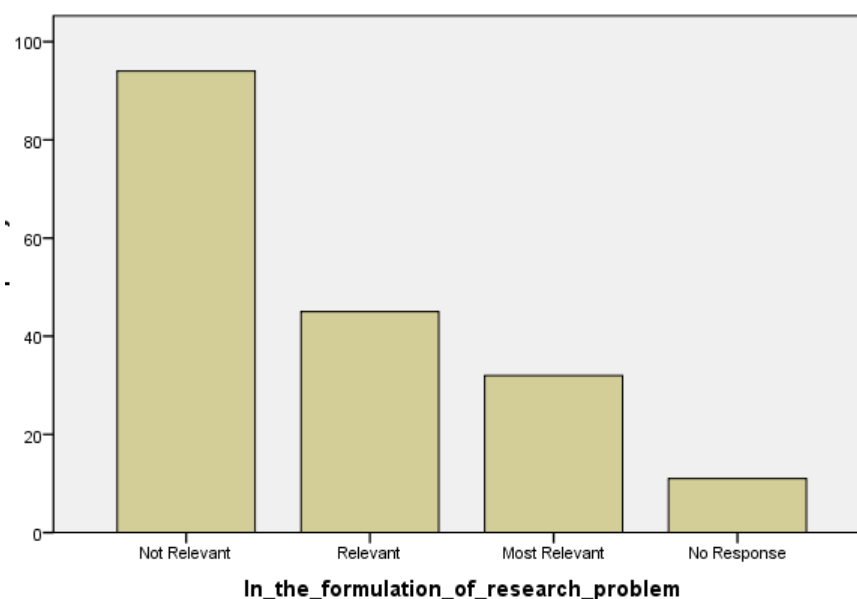


Table 32: Extent of consideration of social differentiation in developing new technologies

In developing new technologies	No. of respondents	Percent
Most Relevant	34	18.7
Relevant	46	25.3
Not Relevant	93	51.1
No Response	9	4.9
Total	182	100.0

Fig. 30: Extent of consideration of social differentiation in developing new technologies

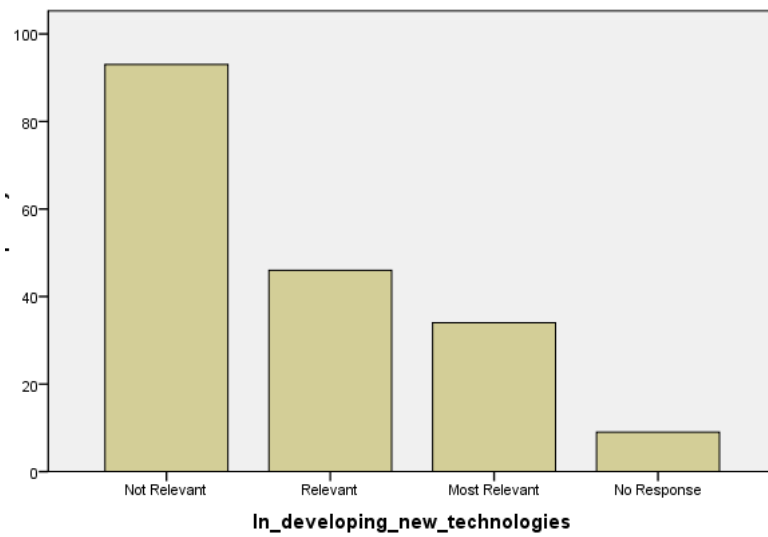


Table 33: Extent of consideration of social differentiation in taking up collaborative project

In taking up collaborative project	No. of respondents	Percent
Most Relevant	20	11.0
Relevant	64	35.2
Not Relevant	88	48.4
No Response	10	5.5
Total	182	100.0

Fig. 31: Extent of consideration of social differentiation in taking up collaborative project

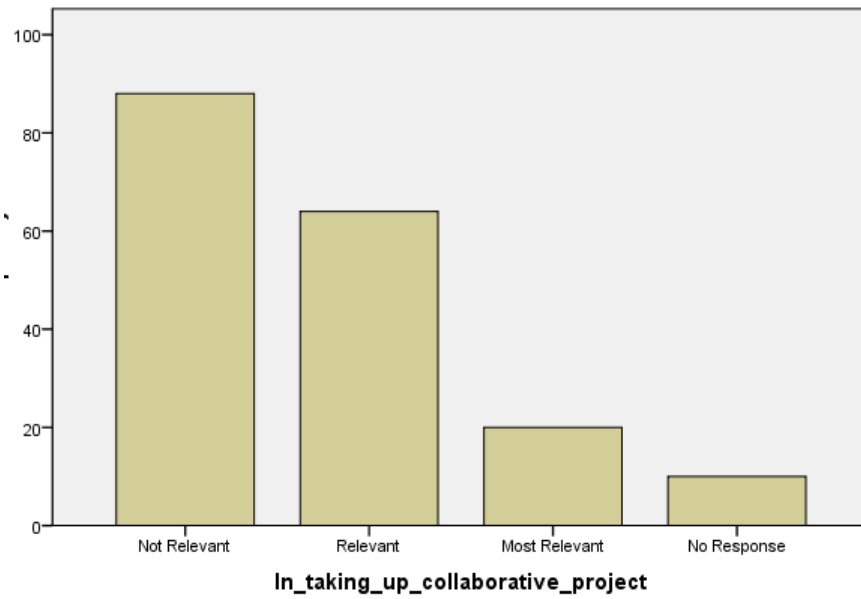


Table 34: Extent of consideration of social differentiation in developing new varieties

In developing new varieties	No. of respondents	Percent
Most Relevant	21	11.5
Relevant	40	22.0
Not Relevant	101	55.5
No Response	20	11.0
Total	182	100.0

Fig. 32: Extent of consideration of social differentiation in developing new varieties

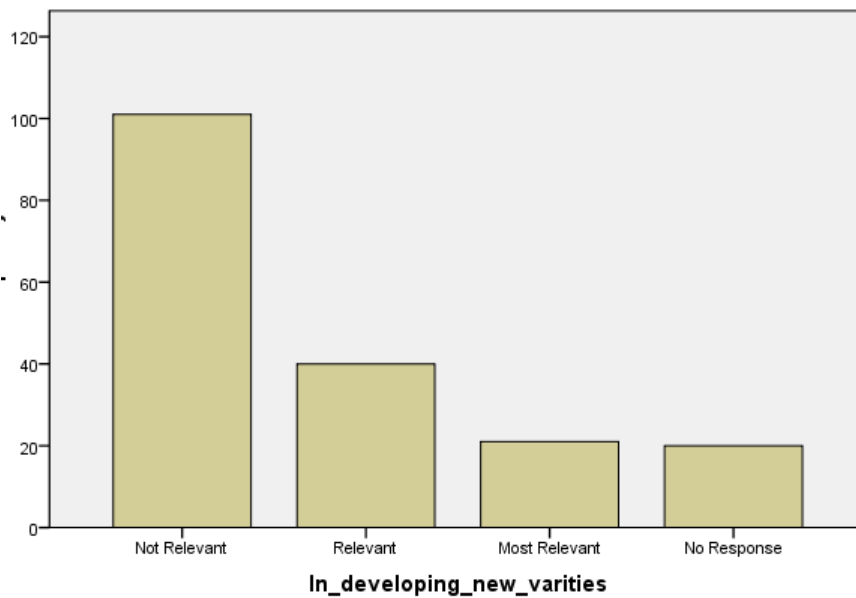
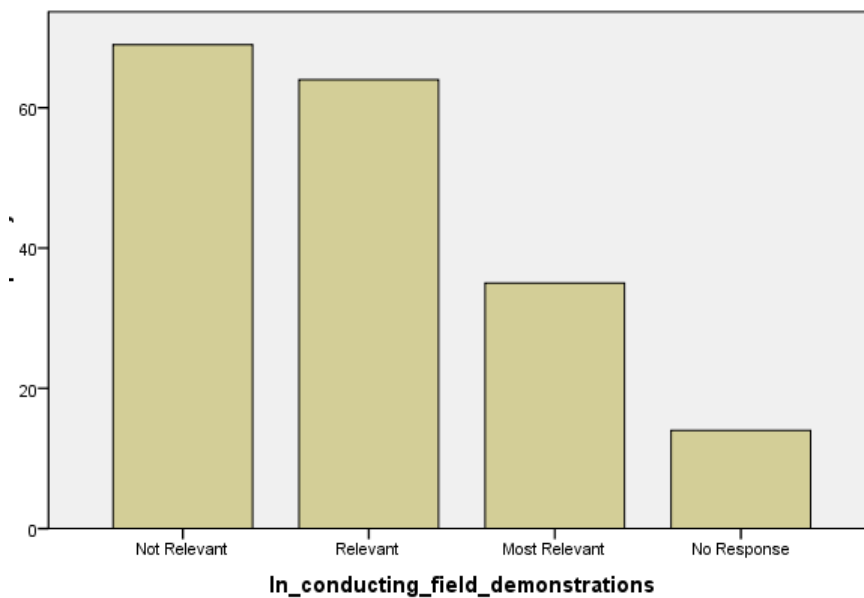


Table 35: Extent of consideration of social differentiation in conducting field demonstrations

In conducting field demonstrations	No. of respondents	Percent
Most Relevant	35	19.2
Relevant	64	35.2
Not Relevant	69	37.9
No Response	14	7.7
Total	182	100.0

Fig. 33: Extent of consideration of social differentiation in conducting field demonstrations



Similarly, it was also attempted to know to what extent the structural differentiation (along the lines of land holding, which is categorised into marginal, small, medium, semi-medium and large farmers) of farmers influences formulation of research problem. The respondents were asked to rank the given five statements in the order of 1 to 5, 1 being most relevant and 5 being least relevant. Out of a total of 179 respondents about 46 percent found that consideration of structural differentiation in the formulation of research problem is most relevant. About 22 percent felt it to be relevant and only about 16 percent felt it to be least relevant (refer Table 36).

About 31 percent felt consideration of structural differentiation in developing new technologies as most relevant. Only nine percent felt it to be not relevant (see Table 37).

On the aspect of considering structural differentiation in taking up collaborative projects only about 15 percent felt it to be most relevant while about 21 percent felt it be not relevant (refer Table 38). To the statement on relevance of consideration of structural differentiation in developing new varieties, about 16 percent felt it to be most relevant while about 19 percent felt it to be not relevant (see Table 39). On the statement that consideration of structural differentiation in conducting field demonstrations about 26 percent of the respondents observed that it is most relevant while about 20 percent felt it to be not relevant (refer Table 40).

Table 36: Extent of consideration of structural differentiation in the formulation of research problem

In the formulation of research problem (Ranks in the order of preference from 1 to 5. 1 being the most relevant 5 being the least relevant )	No. of respondents	Percent
1	83	46.4
2	40	22.3
3	15	8.4
4	9	5.0
5	29	16.2
NR	3	1.7
Total	179	100.0

Fig 34: Extent of consideration of structural differentiation in the formulation of research problem

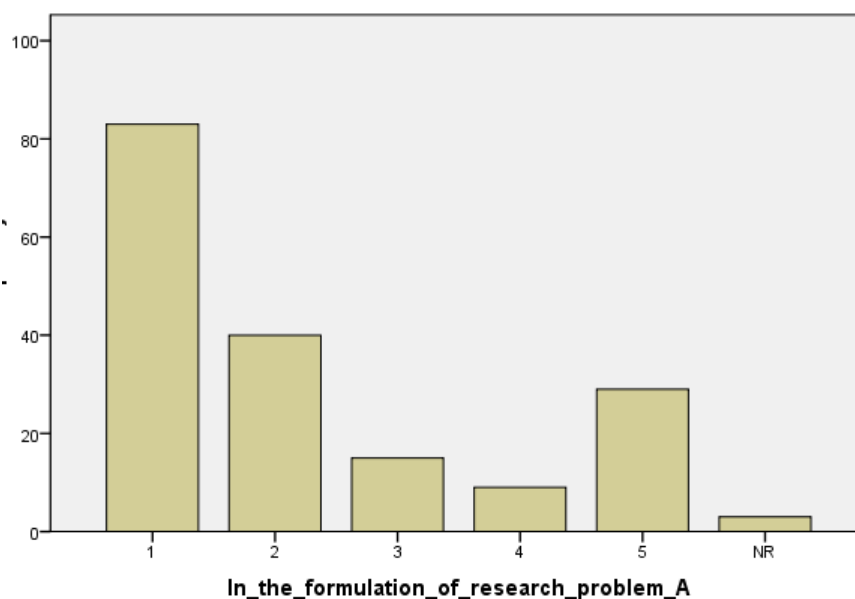


Table 37: Extent of consideration of structural differentiation in developing new technologies

In developing new technologies (Ranks in the order of preference from 1 to 5. 1 being the most relevant 5 being the least relevant )	No. of respondents	Percent
1	56	31.3
2	58	32.4
3	27	15.1
4	15	8.4
5	16	8.9
NR	7	3.9
Total	179	100.0

Fig. 35: Extent of consideration of structural differentiation in developing new technologies

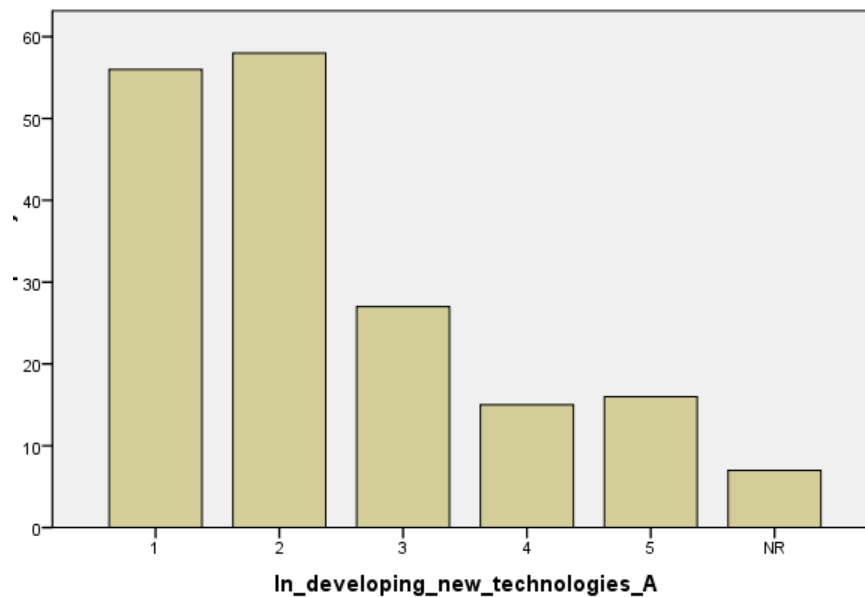


Table 38: Extent of consideration of structural differentiation in taking up collaborative project

In taking up collaborative project (Ranks in the order of preference from 1 to 5. 1 being the most relevant 5 being the least relevant )	No. of respondents	Percent
1	27	15.1
2	40	22.3
3	40	22.3
4	23	12.8
5	38	21.2
NR	11	6.1
Total	179	100.0

Fig. 36: Extent of consideration of structural differentiation in taking up collaborative project

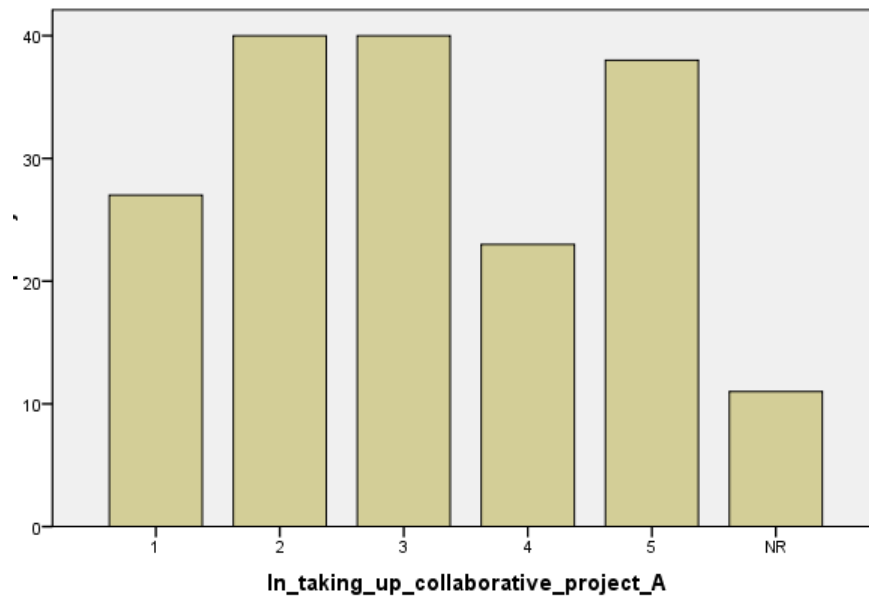


Table 39: Extent of consideration of structural differentiation in developing new varieties

In developing new varieties (Ranks in the order of preference from 1 to 5. 1 being the most relevant 5 being the least relevant )	No. of respondents	Percent
1	29	16.2
2	48	26.8
3	21	11.7
4	33	18.4
5	34	19.0
NR	14	7.8
Total	179	100.0

Fig. 37: Extent of consideration of structural differentiation in developing new varieties

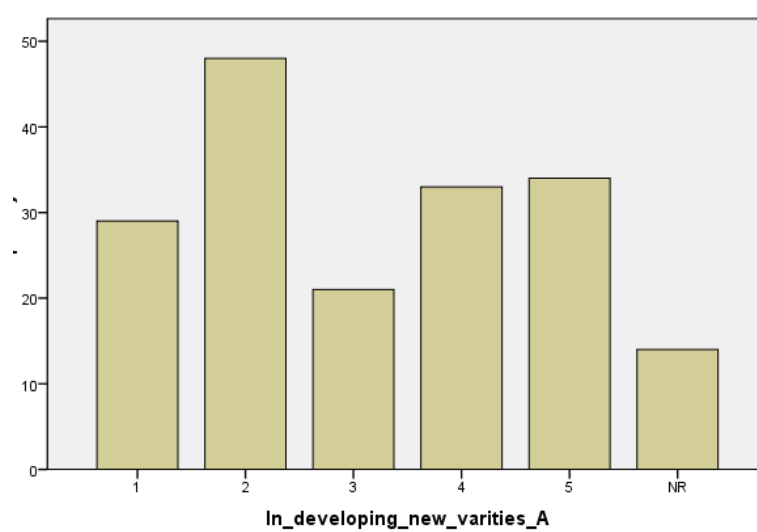
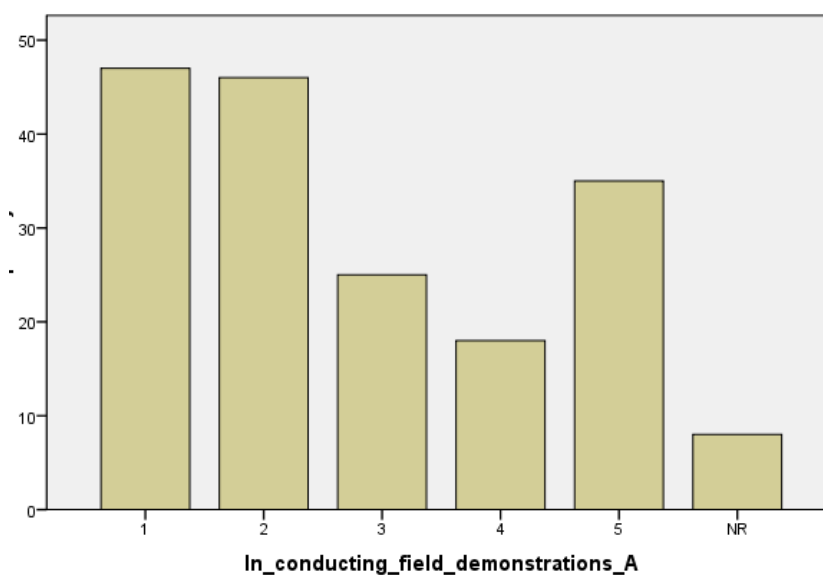


Table 40: Extent of consideration of structural differentiation in conducting field demonstrations

In conducting field demonstrations (Ranks in the order of preference from 1 to 5. 1 being the most relevant 5 being the least relevant )	No. of respondents	Percent
1	47	26.3
2	46	25.7
3	25	14.0
4	18	10.1
5	35	19.6
NR	8	4.5
Total	179	100.0

Fig. 38: Extent of consideration of structural differentiation in conducting field demonstrations



Data suggest that the scientists are aware of the importance of consideration of structural differentiation in agricultural research than social differentiation along caste and gender lines.

## Issues concerning agricultural research

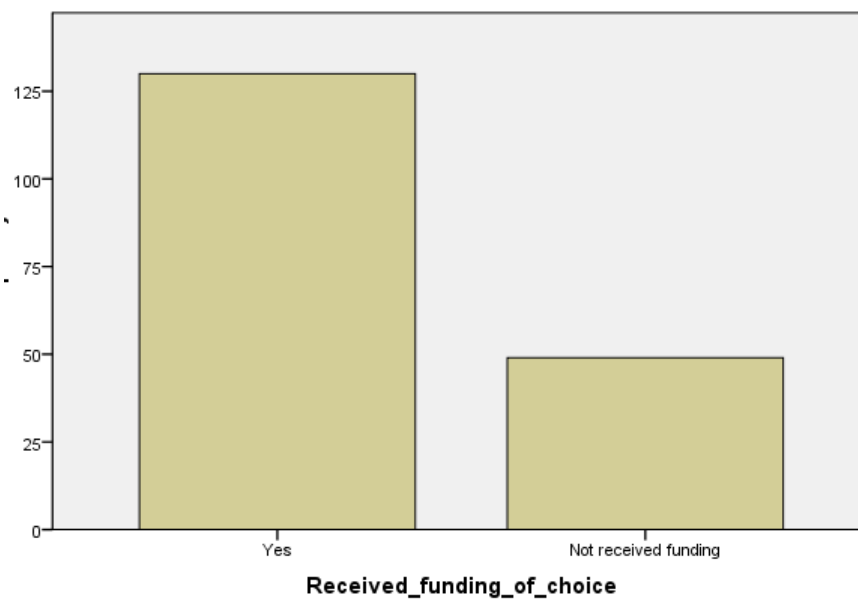
### Funding for research

Agricultural science is funded by state to a large extent and it takes place in the public domain. The funding process is although standardised along the positivist methodologies and sometimes may constrain the researchers' interests. Intending to know the opinions of scientists on the issue of funding for research a question was posed as to know whether they have received funding of their choice a large majority (about 73 percent) agreed that they received funding of their choice. However, significantly, 49 respondents out of 179 responded negatively implying that they did not receive funding for their chosen research problem.

Table 41: Response on receiving funding for research of scientists' choice

Received funding of choice	No. of respondents	Percent
Yes	130	72.6
Not received funding	49	27.4
Total	179	100.0

Fig. 39: Response on receiving funding for research of scientists' choice



A set of statements regarding the reasons for not receiving funding were placed before the scientists to express their opinion. The perception of scientists was elicited in the form of agreement and disagreement on six statements related to the topic of research, insufficient funding, the source of funding, etc. This was asked to all the respondents, irrespective of their response to the earlier question, to cite reasons for non-receipt of funding in general.

Table 42: Reasons for not receiving funding for research of scientists' choice - Doesn't fit into the institution mandate

Doesn't fit into the institution mandate	No. of respondents	Percent
Strongly Agree	22	16.4
Agree	24	17.9
Disagree	35	26.1
Strongly Disagree	15	11.2
Can't say	27	20.1
NR	11	8.2
Total	134	100.0

Although only 49 responded negatively to the earlier question on whether they received funding of their choice, 123 scientists responded to the different statements on reasons for non-receipt of funding of their choice. About 34 percent agreed (including those who strongly agreed) to the statement that their research topic doesn't fit into the institution's mandate (see Table 42) and hence they didn't receive funding. Majority of the respondents, about 53 percent agreed to the statement that they did not receive funding of their choice because the research topic doesn't suit the mandate of the funding agency (see Table 43).

Fig. 40: Reasons for not receiving funding for research of scientists' choice - Doesn't fit into the institution mandate

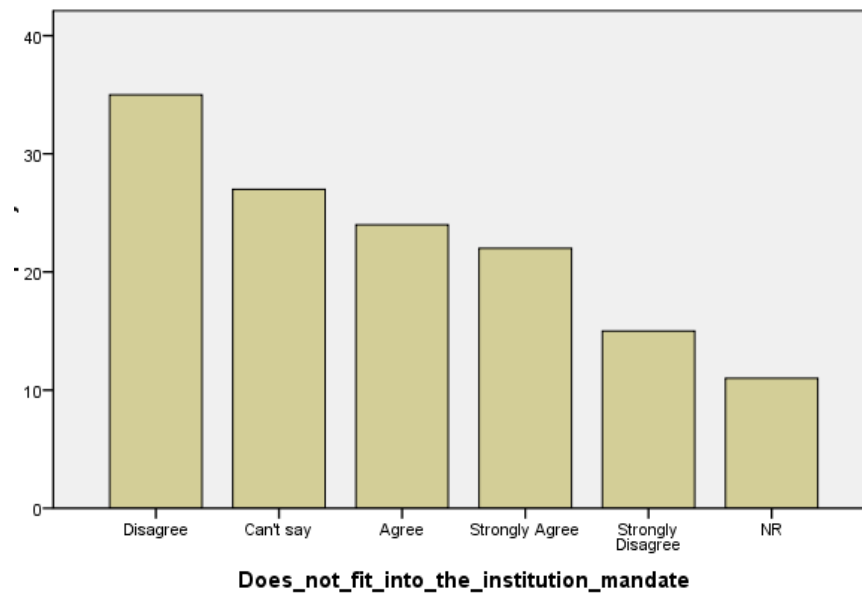
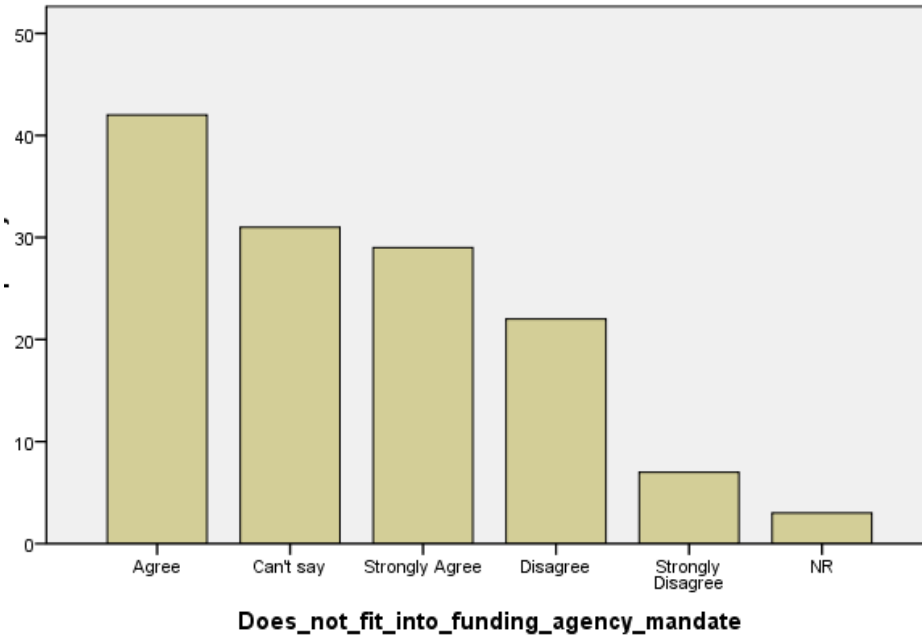


Table 43: Reasons for not receiving funding for research of scientists' choice - Does not fit into funding agency mandate

Does not fit into funding agency mandate	No. of respondents	Percent
Strongly Agree	29	21.6
Agree	42	31.3
Disagree	22	16.4
Strongly Disagree	7	5.2
Can't say	31	23.1
NR	3	2.2
Total	134	100.0

Fig. 41: Reasons for not receiving funding for research of scientists' choice - Does not fit into funding agency mandate

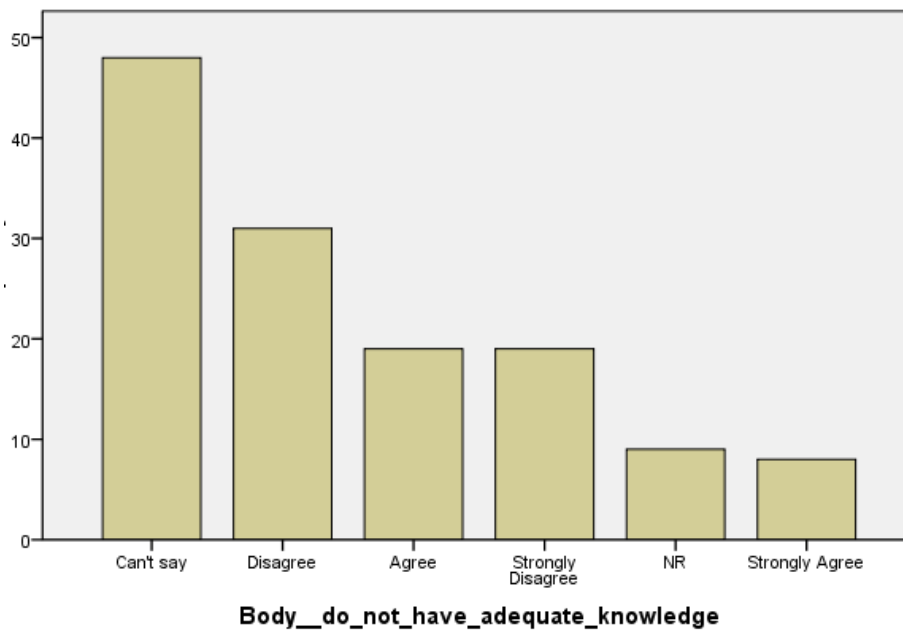


Nature of research project in terms of its familiarity by the funding bodies also plays a role in funding. To the statement that the funding body doesn't have adequate knowledge about the research topic the scientists proposed to work on, about 37 percent responded negatively while only about 20 percent concurred with the statement (see Table 44).

Table 44: Reasons for not receiving funding for research of scientists' choice - Funding body doesn't have adequate knowledge

Funding body doesn't have adequate knowledge	No. of respondents	Percent
Strongly Agree	8	6.0
Agree	19	14.2
Disagree	31	23.1
Strongly Disagree	19	14.2
Can't say	48	35.8
NR	9	6.7
Total	134	100.0

Fig. 42: Reasons for not receiving funding for research of scientists' choice - Funding body doesn't have adequate knowledge



Most interestingly epistemological issues concerning research project also influence funding. To the statement that the proposed topic doesn't fit the standard research protocols about 48 percent disagreed while only about 28 percent agreed with the statement (see Table 45). Responding to the statement that although the funding body considered the research proposal but the board felt that it falls outside the agricultural science paradigm about 43 percent disagreed with the statement (see Table 46). Response to the statement that proposed topic was viewed as difficult to evaluate against its outcomes as the outcomes were somewhat intangible was balanced as equal number of respondents agreed and disagreed. A majority of the respondents (about 36 percent) were non-committal (see Table 47).

Table 45: Reasons for not receiving funding for research of scientists' choice - Does not fit the standard research protocol

Does not fit the standard research protocol	No. of respondents	Percent
Strongly Agree	6	4.5
Agree	31	23.1
Disagree	45	33.6
Strongly Disagree	19	14.2
Can't say	27	20.1
NR	6	4.5
Total	134	100.0

Fig. 43: Reasons for not receiving funding for research of scientists' choice - Does not fit the standard research protocol

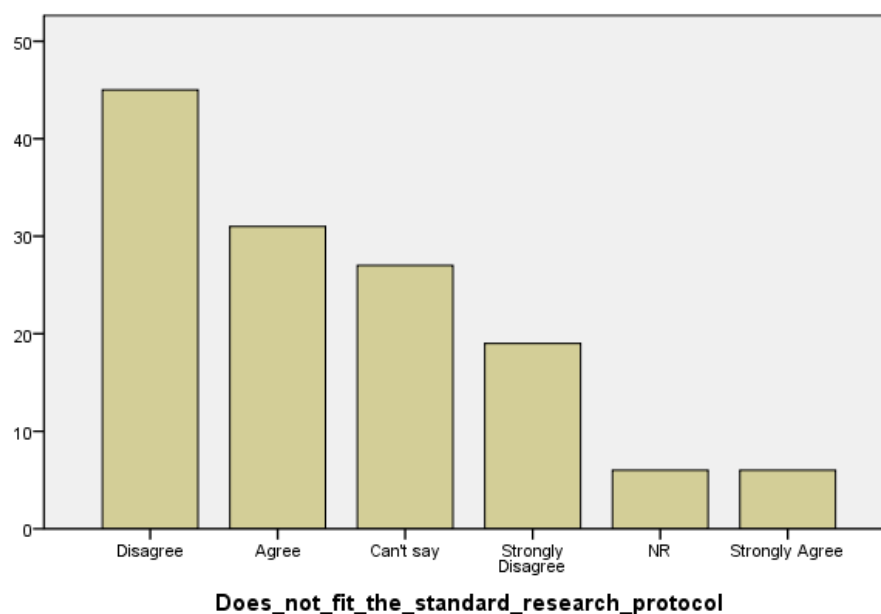


Table 46: Reasons for not receiving funding for research of scientists' choice - Outside agricultural science paradigm

Outside agricultural science paradigm	No. of respondents	Percent
Strongly Agree	9	6.7
Agree	21	15.7
Disagree	40	29.9
Strongly Disagree	17	12.7
Can't say	40	29.9
NR	7	5.2
Total	134	100.0

Fig. 44: Reasons for not receiving funding for research of scientists' choice - Outside agricultural science paradigm

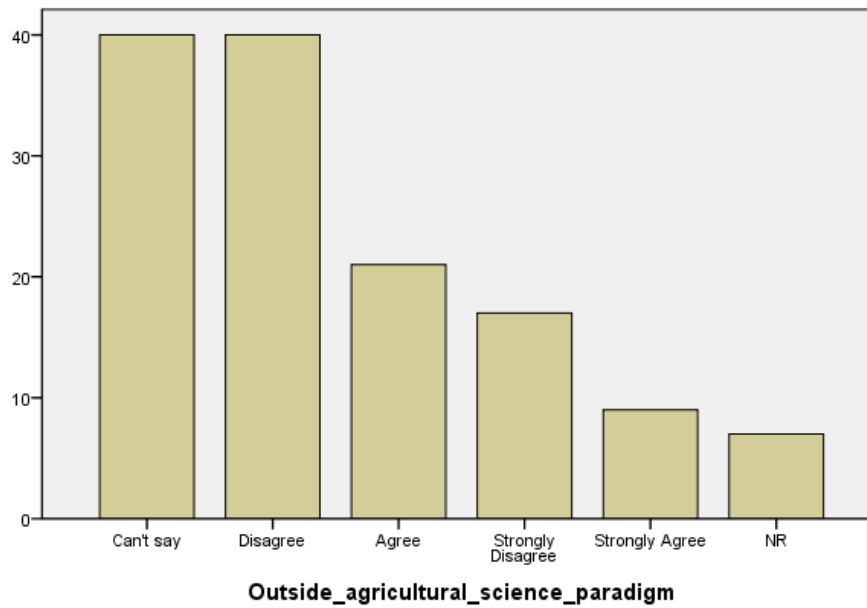
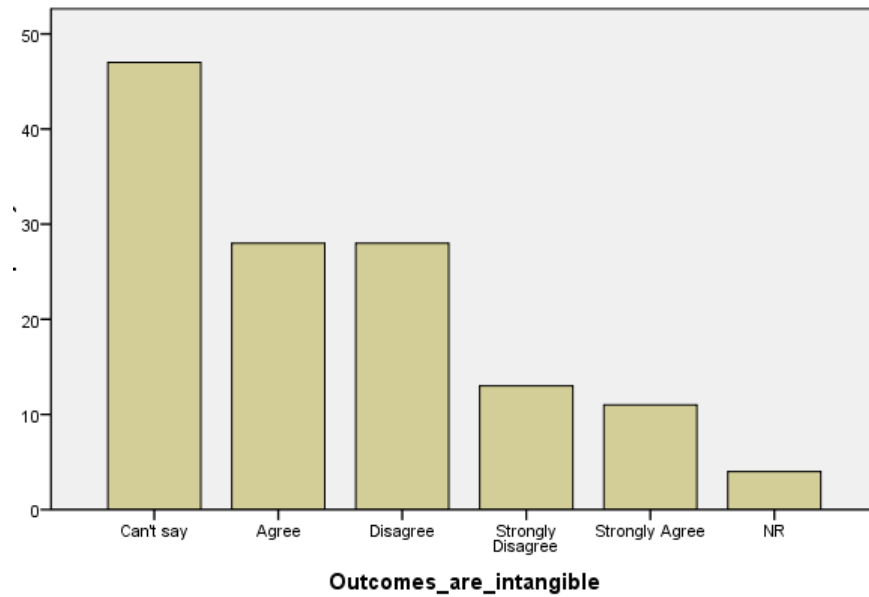


Table 47: Reasons for not receiving funding for research of scientists' choice - Outcomes are intangible

Outcomes are intangible	No. of respondents	Percent
Strongly Agree	11	8.4
Agree	28	21.4
Disagree	28	21.4
Strongly Disagree	13	9.9
Can't say	47	35.9
NR	4	3.1
Total	131	100.0

Fig. 45: Reasons for not receiving funding for research of scientists' choice - Outcomes are intangible

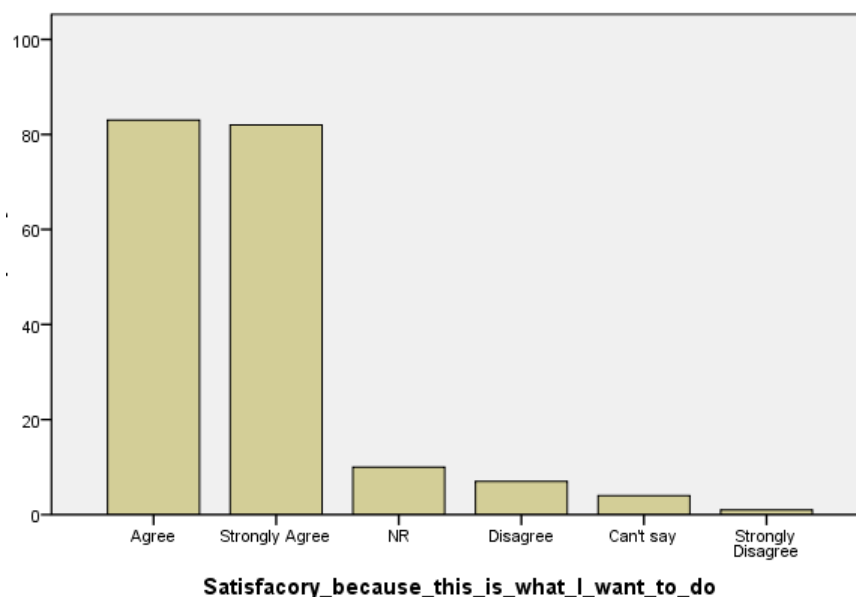


In order to understand the levels of satisfaction with the research problem the scientists are handling a question was posed to the respondents. About 44 percent of the respondents strongly agreed with the statement that the research problem is satisfactory while about 44 percent agreed. It may be said that an overwhelming majority of the respondents (about 88 percent) expressed satisfaction about the research problem they are currently pursuing (see Table 48).

Table 48: Perceptions on the research problem scientists handling

Satisfactory because this is what I want to do	No. of respondents	Percent
Strongly Agree	82	43.9
Agree	83	44.4
Disagree	7	3.7
Strongly Disagree	1	.5
Can't say	4	2.1
NR	10	5.3
Total	187	100.0

Fig. 46: Perceptions on the research problem scientists handling

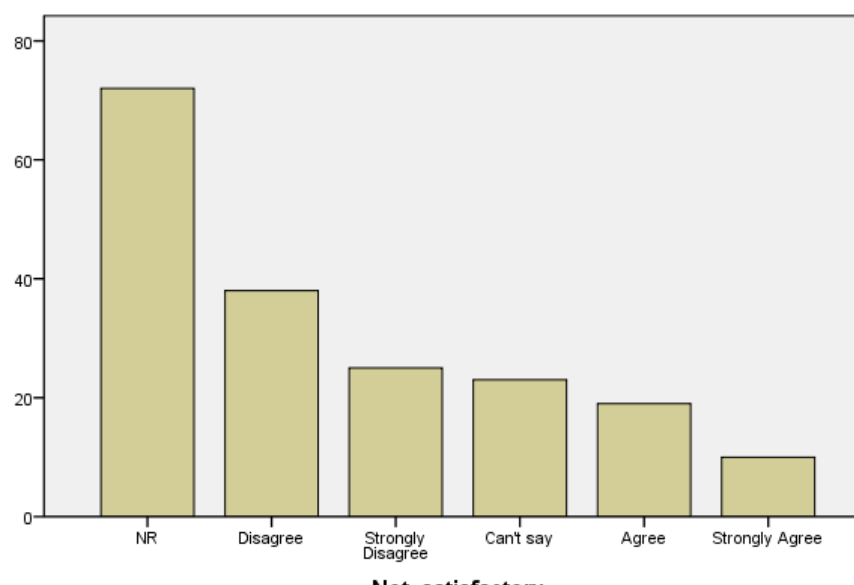


Only about 16 percent of 187 respondents agreed with the statement that the research problem they are handling is not satisfactory and they could have handled a better one (see Table 49). A significant percentage i.e. about 39 percent were non-committal.

Table 49: Perceptions on the research problem scientists handling - Not satisfactory

It is not satisfactory as I feel I could handle a better one	No. of respondents	Percent
Strongly Agree	10	5.3
Agree	19	10.2
Disagree	38	20.3
Strongly Disagree	25	13.4
Can't say	23	12.3
NR	72	38.5
Total	187	100.0

Fig. 47: Perceptions on the research problem scientists handling - Not satisfactory



### Conduct of research

In order to understand the problems associated with agricultural research a set of statements, arrived at through interaction with scientists prior to the preparation of survey and during the pre-testing stage, were given. The respondents recorded their perception in the order of relevance ranging from one to five against each statement. It may be observed from Table 50 that 65 percent respondents were of the opinion that lack of trained laboratory staff has been a major problem in conducting research. About 46 percent of the respondents observed that lack of motivated students is a concern (see Table 51). Similarly about 48 percent of the respondents expressed concern over lack of funding for research area of one's interest (see Table 52). On the question of lack of space for experimental plots for conducting research only about 36 percent agreed while about 47 percent disagreed (see Table 53). On the issue of feedback from farmers, majority of the respondents (about 47 percent) stated that they have no problem with relation to the feedback from farmers while about 28 percent expressed concern over it (see Table 54). About 50 percent of the respondents raised concern over the issue of lack of skilled workers for conducting research (see Table 55).

Table 50: Problems associated with the conduct of research - Lack of trained laboratory staff

Lack of trained laboratory staff	No. of respondents	Percent
Strongly Agree	43	23.0
Agree	78	41.7
Disagree	35	18.7
Strongly Disagree	9	4.8
Can't Say	9	4.8
NR	13	7.0
Total	187	100.0

Fig. 48: Problems associated with the conduct of research - Lack of trained laboratory staff

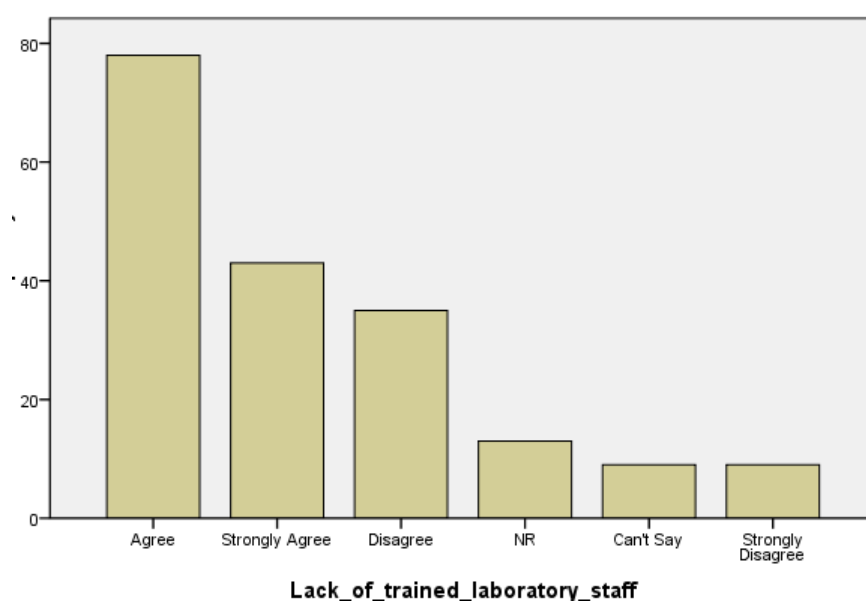


Table 51: Problems associated with the conduct of research - Lack of motivated students

Lack of motivated students	No. of respondents	Percent
Strongly Agree	22	11.8
Agree	64	34.2
Strongly Disagree	5	2.7
Disagree	55	29.4
Can't Say	30	16.0
NR	11	5.9
Total	187	100.0

Fig. 49: Problems associated with the conduct of research - Lack of motivated students

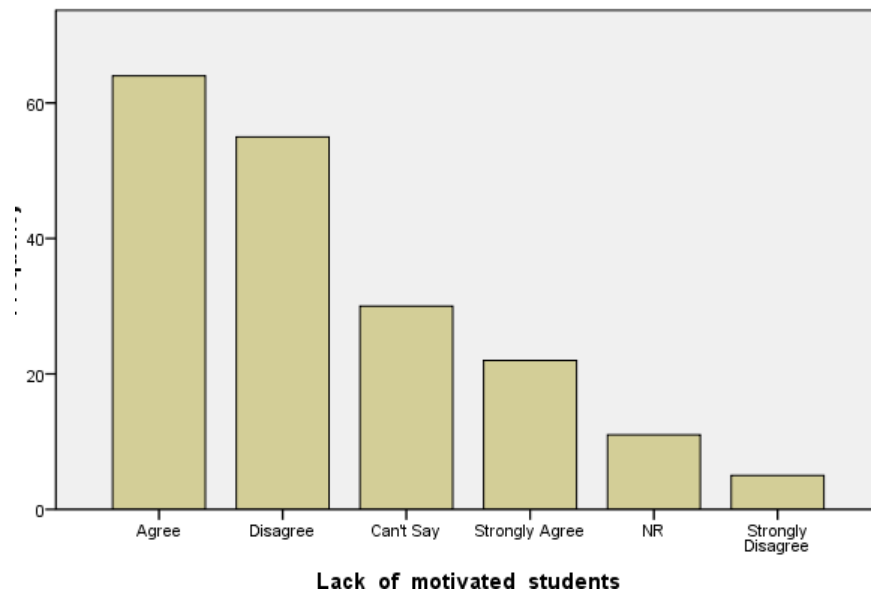


Table 52: Problems associated with the conduct of research - Lack of funding for area of my interest

Lack of funding for area of my interest	No. of respondents	Percent
Strongly Agree	35	18.7
Agree	55	29.4
Disagree	51	27.3
Strongly Disagree	9	4.8
Can't say	23	12.3
NR	14	7.5
Total	187	100.0

Fig. 50: Problems associated with the conduct of research - Lack of funding for area of my interest

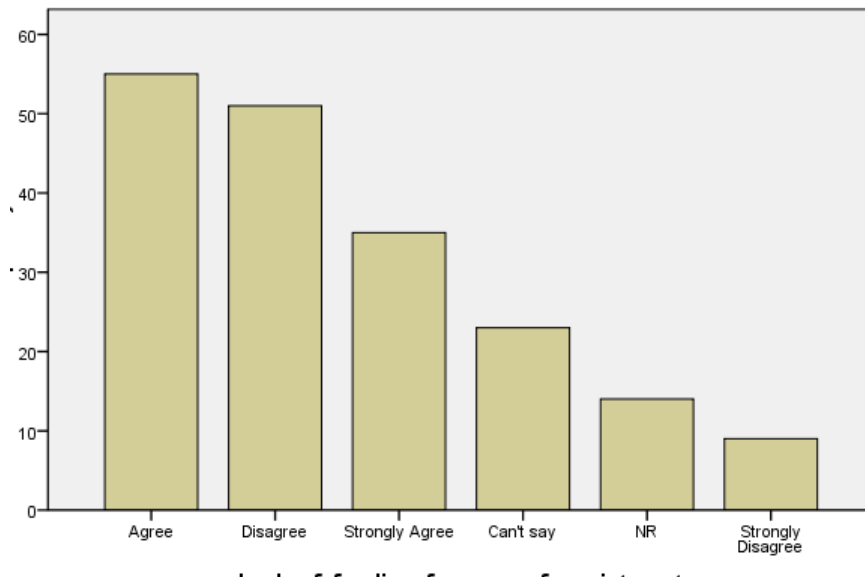


Table 53: Problems associated with the conduct of research - Lack of space for experimental plots

Lack of space for experimental plots	No. of respondents	Percent
Agree	48	25.7
Strongly Agree	19	10.2
Disagree	72	38.5
Strongly Disagree	15	8.0
Can't Say	18	9.6
NR	15	8.0
Total	187	100.0

Fig. 51: Problems associated with the conduct of research - Lack of space for experimental plots



Table 54: Problems associated with the conduct of research - Lack of proper feedback from farmers

Lack of proper feedback from farmers	No. of respondents	Percent
Strongly Agree	13	7.0
Agree	40	21.4
Disagree	69	36.9
Strongly Disagree	18	9.6
Can't Say	32	17.1
NR	15	8.0
Total	187	100.0

Fig 52: Problems associated with the conduct of research - Lack of proper feedback from farmers

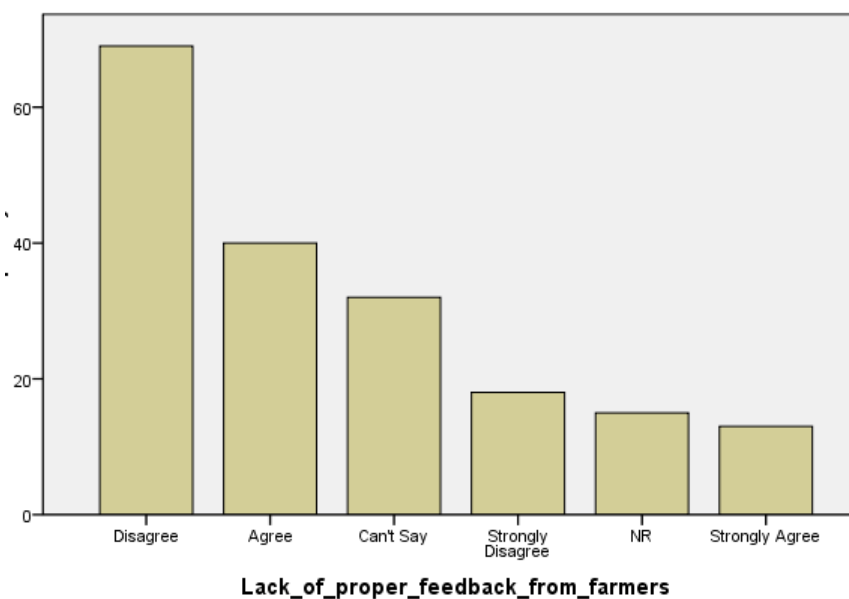
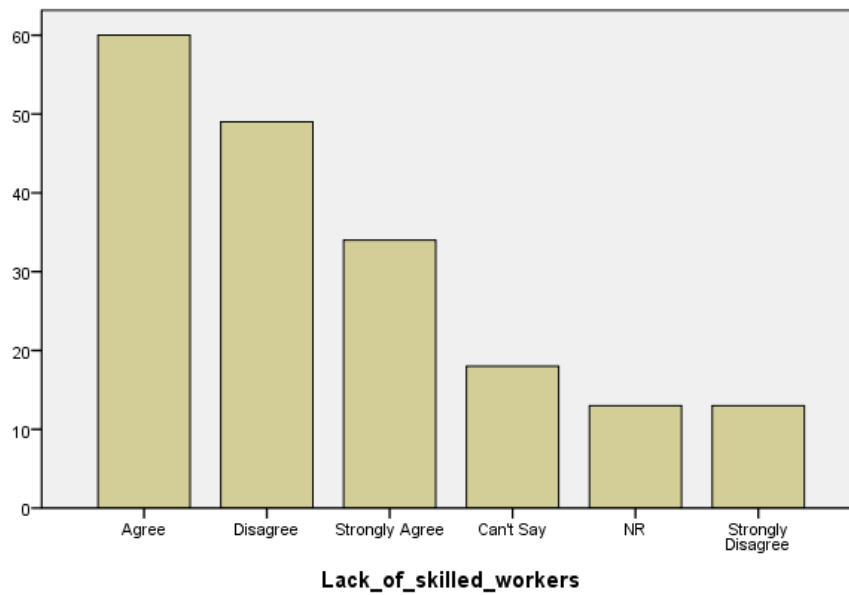


Table 55: Problems associated with the conduct of research - Lack of skilled workers

Lack of skilled workers	No. of respondents	Percent
Strongly Agree	34	18.2
Agree	60	32.1
Disagree	49	26.2
Strongly Disagree	13	7.0
Can't Say	18	9.6
NR	13	7.0
Total	187	100.0

Fig. 53: Problems associated with the conduct of research - Lack of skilled workers

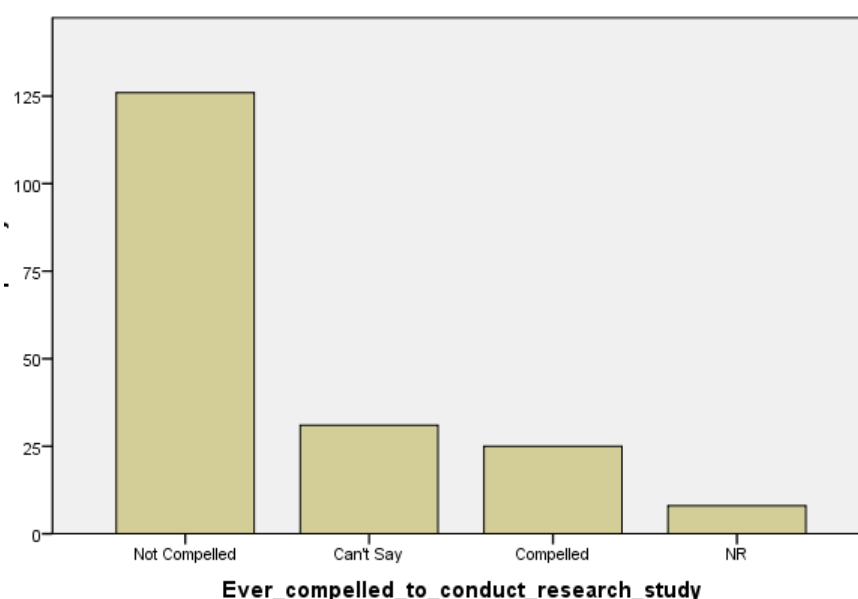


Continuing the exercise to understand the perception of scientists on the research problem they are handling, another question was asked as to know whether they were ever compelled to do research not of their choice. Responding to this a large majority (about 66 percent) responded negatively. Only about 13 percent responded saying that they were compelled to carry out research which is of not their choice.

Table 56: Felt compelled to conduct a research project of not of their choice

Compelled to conduct research study	No. of respondents	Percent
Compelled	25	13.2
Not Compelled	126	66.3
Can't Say	31	16.3
NR	8	4.2
Total	190	100.0

Fig. 54: Felt compelled to conduct a research project of not of their choice



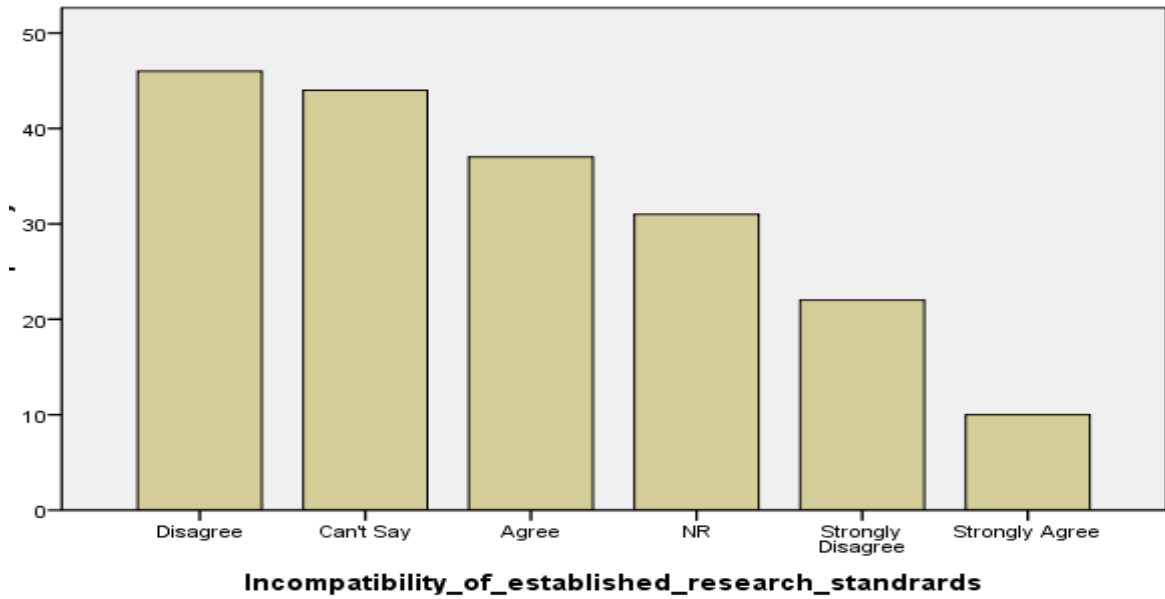
Probing further on the issues of funding for research a set of statements was put before the scientists to know the instances, in general, wherein funding for research was denied due to reasons like incompatibility of established research standards, something that doesn't fit into the institution's mandate, etc.

Responding to the first statement i.e. incompatibility of established research standards as the reason for not receiving funding, majority of the respondents (about 36 percent) disagreed while about 23 percent did not respond. About 25 percent of the respondents agreed with the statement indicating the general tendency of denying of funding if the research problem and the methods adopted don't follow the established standards (see Table 57).

Table 57: Reasons for not receiving funding - Incompatibility of established research standards

Incompatibility of established research standards	No. of respondents	Percent
Strongly Agree	10	5.3
Agree	37	19.5
Disagree	46	24.2
Strongly Disagree	22	11.6
Can't Say	44	23.2
NR	31	16.3
Total	190	100.0

Fig. 55: Reasons for not receiving funding - Incompatibility of established research standards

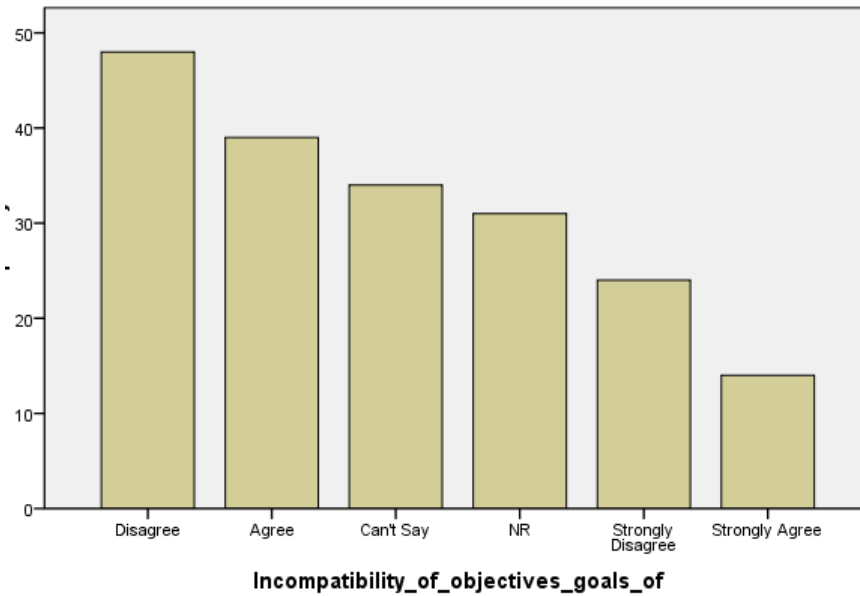


Responding to the statement that incompatibility of objectives or goals of research as the reason for not receiving funding for research, about 38 percent of the respondents disagreed while about 28 percent agreed (see Table 58). However, majority of the respondents (about 34 percent) preferred not to respond (both, no response and can't say categories).

Table 58: Reasons for not receiving funding - Incompatibility of objectives/goals of research

Incompatibility of objectives/goals of research	No. of respondents	Percent
Strongly Agree	14	7.4
Agree	39	20.5
Disagree	48	25.3
Strongly Disagree	24	12.6
Can't Say	34	17.9
NR	31	16.3
Total	190	100.0

Fig. 56: Reasons for not receiving funding - Incompatibility of objectives/goals of research

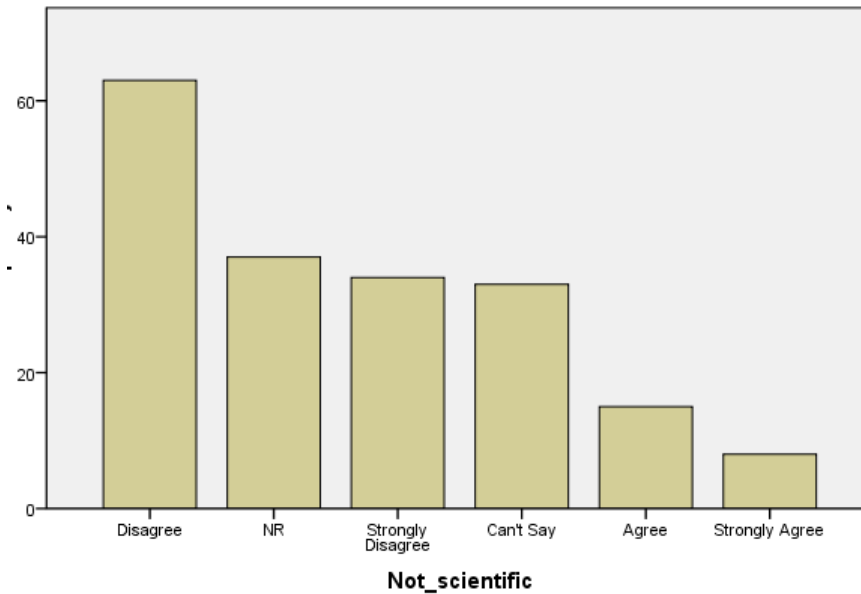


A large majority of the respondents (about 51 percent) disagreed with the statement that funding was denied because the research proposal was considered as not scientific. A significant percent of the respondents, about 35 percent, preferred not to respond or responded saying can't say (see Table 59).

Table 59: Reasons for not receiving funding - Not scientific

Not scientific	No. of respondents	Percent
Strongly Agree	8	4.2
Agree	15	7.9
Disagree	63	33.2
Strongly Disagree	34	17.9
Can't Say	33	17.4
NR	37	19.5
Total	190	100.0

Fig. 57: Reasons for not receiving funding - Not scientific

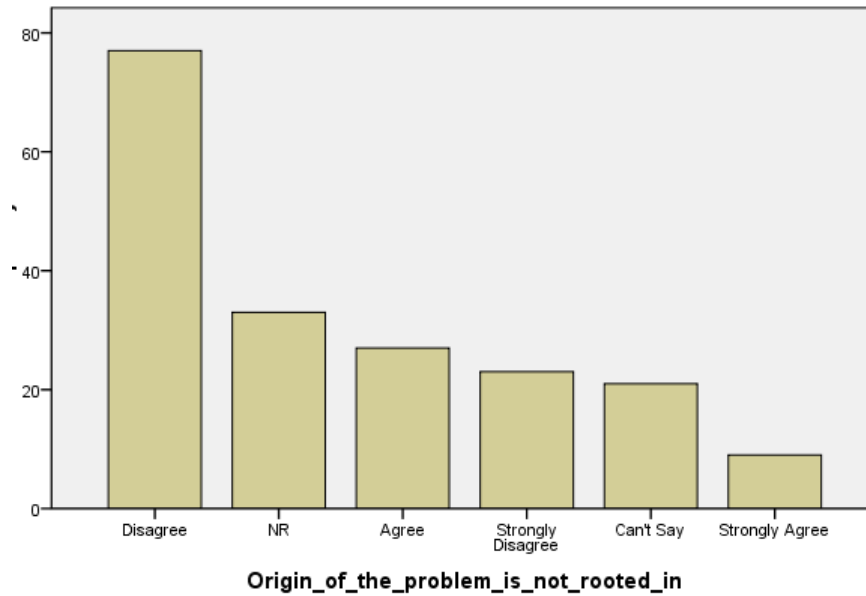


Continuing to probe on the reasons for not receiving funding a statement ‘origin of the problem is not rooted in agricultural sciences’ was posed to the scientists. Majority of the respondents, about 53 percent, disagreed while only about 19 percent agreed (see Table 60).

Table 60: Reasons for not receiving funding - Origin of the problem is not rooted in agricultural sciences

Origin of the problem is not rooted in agricultural sciences	No. of respondents	Percent
Strongly Agree	9	4.7
Agree	27	14.2
Disagree	77	40.5
Strongly Disagree	23	12.1
Can't Say	21	11.1
NR	33	17.4
Total	190	100.0

Fig. 58: Reasons for not receiving funding - Origin of the problem is not rooted in agricultural sciences

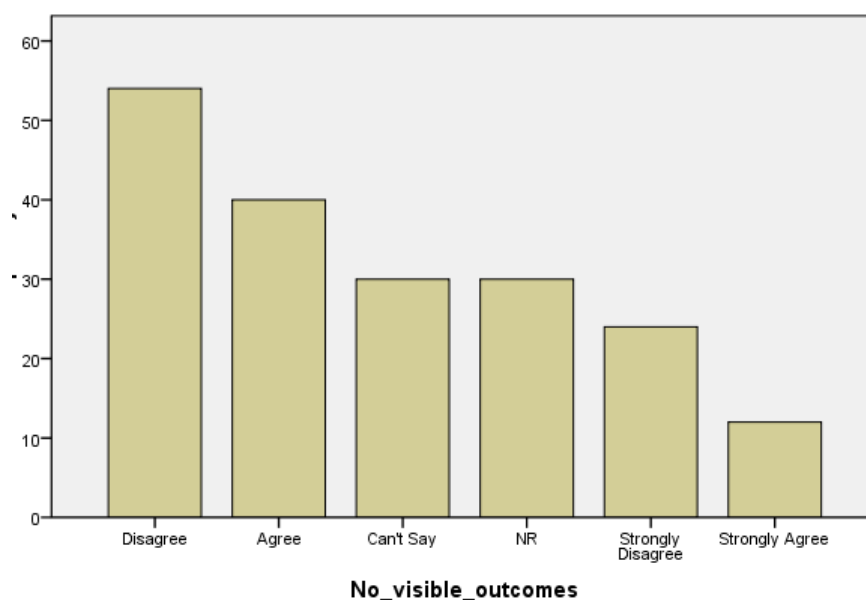


Positivist research privileges empirical evidence and modern science methods are standardised along these lines. It is imperative for the researchers to state the methods used in the measurement of outcomes of research in the research proposal. The underlying assumption is that each research proposal that receives funding must clearly state the visible outcomes. Greater the possibility of visibility/measurability of outcomes, for example, increase in yield, reduced water requirement, etc. higher is the chance for receiving funding. However, certain research proposals focusing on the long term benefits of the research, for example, organic farming, non-pesticidal management, etc. cannot showcase the immediate visible outcomes. The outcomes of such research may be long term based, for instance, organic farming may improve soil biota and thus will increase fertility status as well as moisture retention, which will be reflected in higher yields after three or four seasons. Intending to know whether such difficulty was faced by the scientists a question was asked and to which about 41 percent responded negatively while 27 percent agreed (see Table 61).

Table 61: Reasons for not receiving funding - No visible outcomes

No visible outcomes	No. of respondents	Percent
Strongly Agree	12	6.3
Agree	40	21.1
Disagree	54	28.4
Strongly Disagree	24	12.6
Can't Say	30	15.8
NR	30	15.8
Total	190	100.0

Fig. 59: Perceptions of the reasons for not receiving funding - No visible outcomes

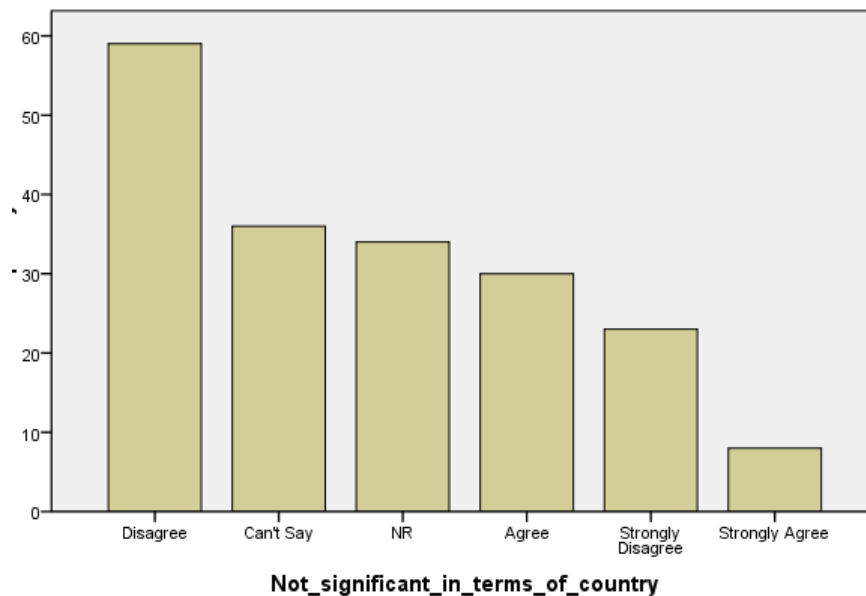


Agricultural science research carries the burden of meeting the challenges the country faces. Hence the research is directed at nation's priorities. A statement was put before the scientists in this regard and to which about 43 percent disagreed while about 20 percent agreed. In other words, funding for research was not denied based on the criterion that the objectives of the research do not match with nation's priorities (see Table 62).

Table 62: Reasons for not receiving funding - Not significant in terms of nation's priorities

Not significant in terms of nation's priorities	No. of respondents	Percent
Strongly Agree	8	4.2
Agree	30	15.8
Disagree	59	31.1
Strongly Disagree	23	12.1
Can't Say	36	18.9
NR	34	17.9
Total	190	100.0

Fig. 60: Reasons for not receiving funding - Not significant in terms of nation's priorities

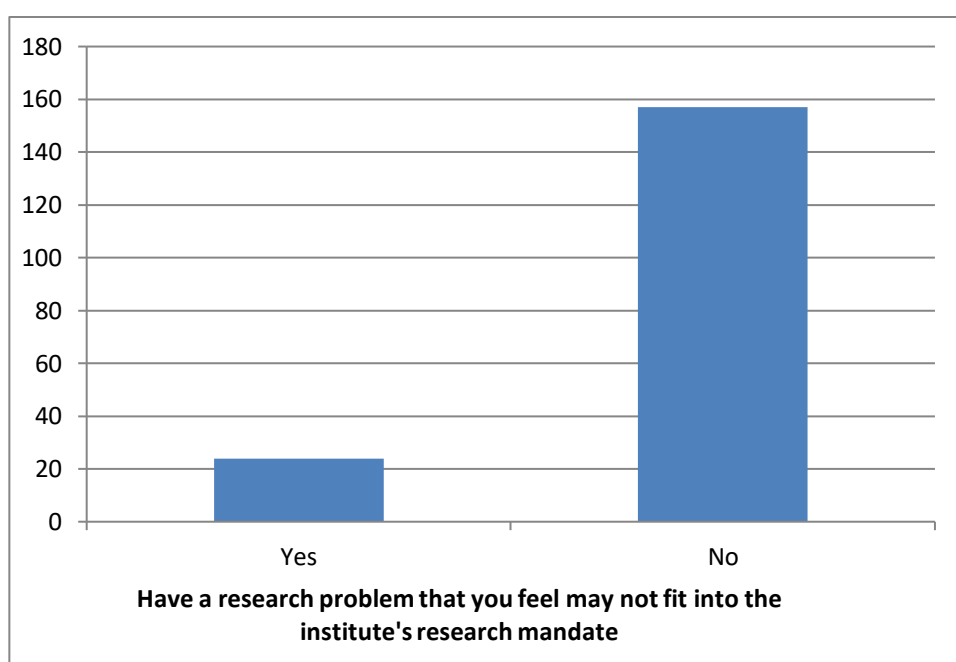


Research problems are drawn based on the priorities set by the institution in which the scientists are working. Sometimes it is possible that the scientists may come across research questions which may not fit the institution's goals of research. Contradiction due to the mismatch may lead to conflicting situations. In order to know whether scientists ever had a research problem that contradicted the institutions' research mandate a question was asked. Responding to this a large majority (about 87 percent) suggested that they don't have a research problem that doesn't fit the institute's research mandate. However, about 13 percent reported to have a research problem that doesn't fit the institute's research mandate (see Table 63).

Table 63: Suitability of the research problem with the institution’s research mandate

Do you have a research problem that you feel may not fit into the institute's research mandate?	No. of respondents	Percent
Yes	24	13.3
No	157	86.7
Total	181	100.0

Fig. 61: Suitability of the research problem with the institution’s research mandate



Although a majority of the respondents reported that they don’t have a research problem that doesn’t fit the institute’s mandate an attempt was made in this study to know the reasons for the mismatch between the scientists’ research problem and the institution’s mandate in general through a set of statements. A large majority (78 percent) preferred not to respond to the statement ‘incompatible with the established research standards’, 21 respondents did not agree while 13 respondents agreed with the statement (see Table 64). With reference to the statement ‘incompatible focus’ of the research problem 18 respondents disagreed while 16 agreed (see Table 65). However, 19 respondents agreed with the statement ‘incompatible with the funding agency mandate’ while 15 respondents did not agree (see Table 66). Another statement ‘incompatible with the standard research

protocols' was posed to the respondents for which 20 disagreed while only 12 agreed (see Table 67). Responding to the statement 'incompatible with the existing standards of evaluation' 14 respondents agreed while 17 respondents disagreed (see Table 68). Interestingly 21 respondents agreed with the statement that 'incompatible with the priorities of the institute' as the reason for non-suitability of research problem, while 17 disagreed (see Table 69).

Table 64: Perceptions on the non-suitability of the research problem with the institution's research mandate - Incompatible with the established research standards

Incompatible with the established research standards	No. of respondents	Percent
Strongly Agree	6	3.3
Agree	7	3.9
Disagree	13	7.2
Strongly Disagree	8	4.4
Can't say	6	3.3
NR	141	77.9
Total	181	100.0

Fig. 62: Perceptions on the non-suitability of the research problem with the institution's research mandate - Incompatible with the established research standards

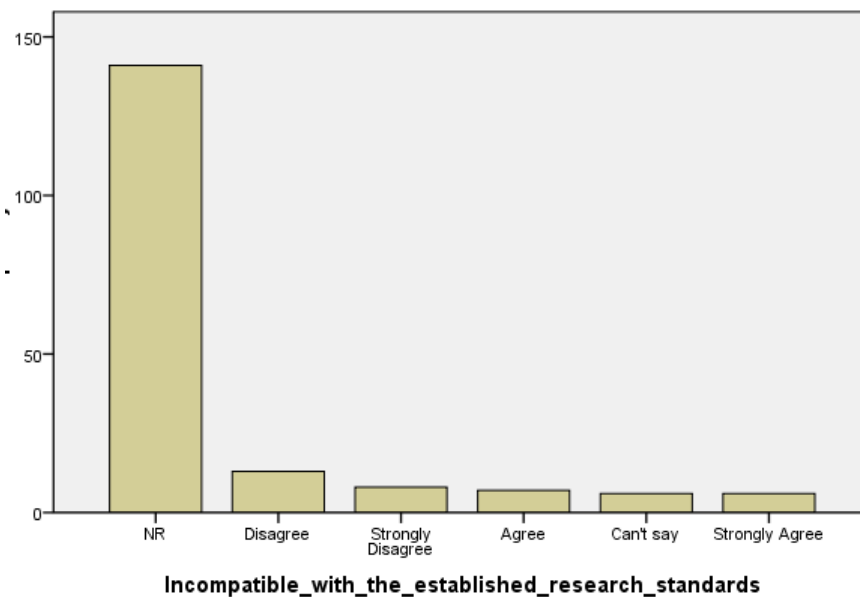


Table 65: Perceptions on the non-suitability of the research problem with the institution's research mandate - Incompatible focus

Incompatible focus	No. of respondents	Percent
Agree	16	8.8
Disagree	11	6.1
Strongly Disagree	7	3.9
Can't Say	6	3.3
NR	141	77.9
Total	181	100.0

Fig. 63: Perceptions on the non-suitability of the research problem with the institution's research mandate - Incompatible focus

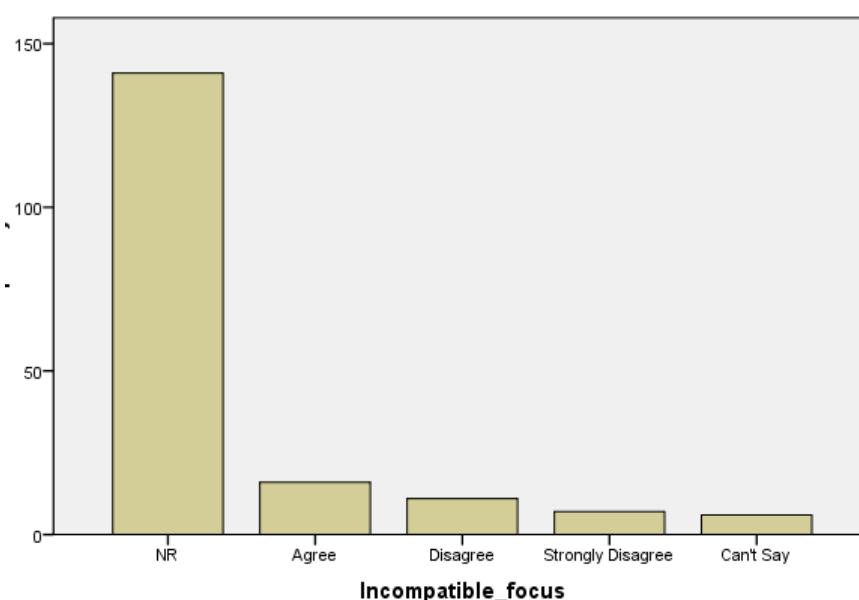


Table 66: Perceptions on the non-suitability of the research problem with the institution's research mandate - Incompatible with the funding agency mandate

Incompatible with the funding agency mandate	No. of respondents	Percent
Strongly Agree	4	2.2
Agree	15	8.3
Disagree	8	4.4
Strongly Disagree	7	3.9
Can't Say	5	2.8
NR	142	78.5
Total	181	100.0

Fig. 64: Perceptions on the non-suitability of the research problem with the institution's research mandate - Incompatible with the funding agency mandate

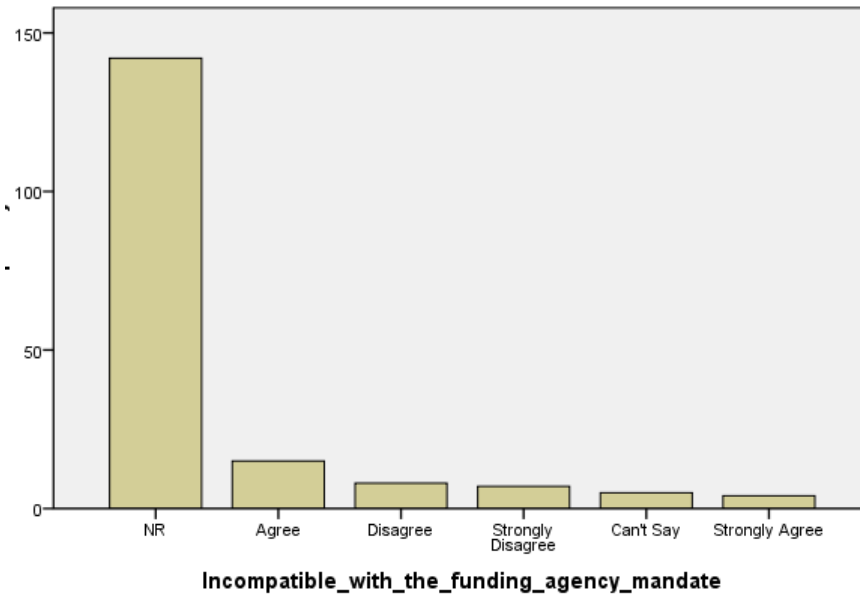


Table 67: Perceptions on the non-suitability of the research problem with the institution's research mandate - Incompatible with the standard research protocols

Incompatible with the standard research protocols	No. of respondents	Percent
Strongly Agree	1	.6
Agree	11	6.1
Disagree	16	8.8
Strongly Disagree	4	2.2
Can't Say	7	3.9
NR	142	78.5
Total	181	100.0

Fig. 65: Perceptions on the non-suitability of the research problem with the institution’s research mandate - Incompatible with the standard research protocols

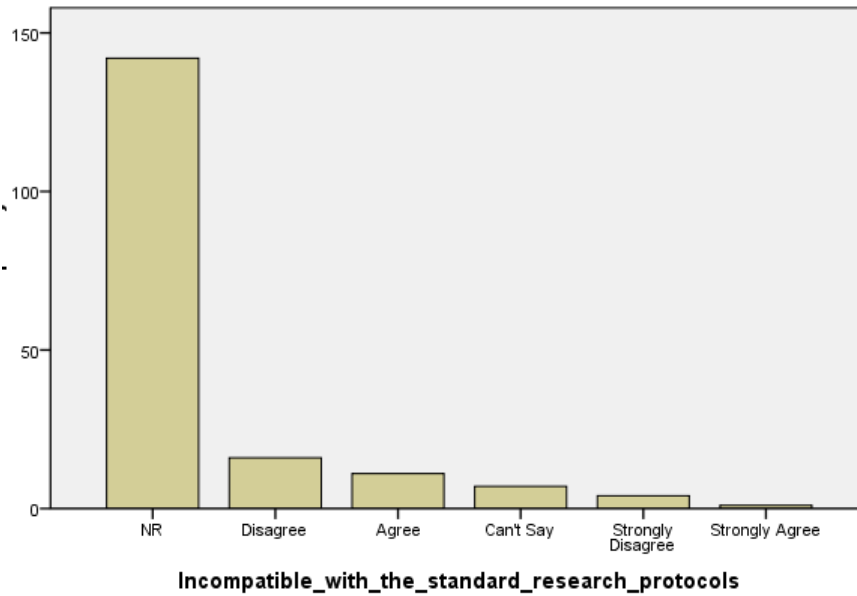


Table 68: Perceptions on the non-suitability of the research problem with the institution’s research mandate - Incompatible with the existing standards of evaluation

Incompatible with the existing standards of evaluation	No. of respondents	Percent
Strongly Agree	4	2.2
Agree	10	5.5
Disagree	12	6.6
Strongly Disagree	5	2.8
Can't Say	9	5.0
NR	141	77.9
Total	181	100.0

Fig. 66: Perceptions on the non-suitability of the research problem with the institution’s research mandate - Incompatible with the existing standards of evaluation

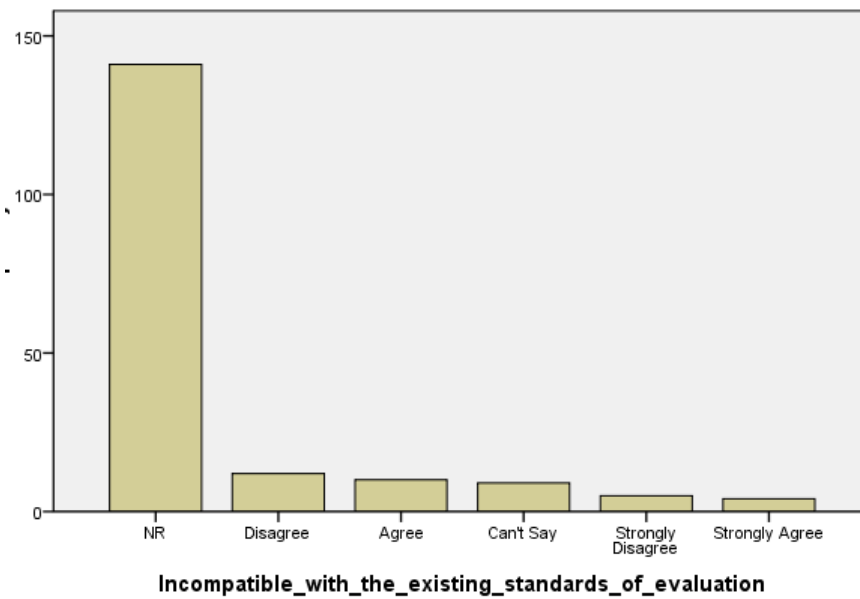
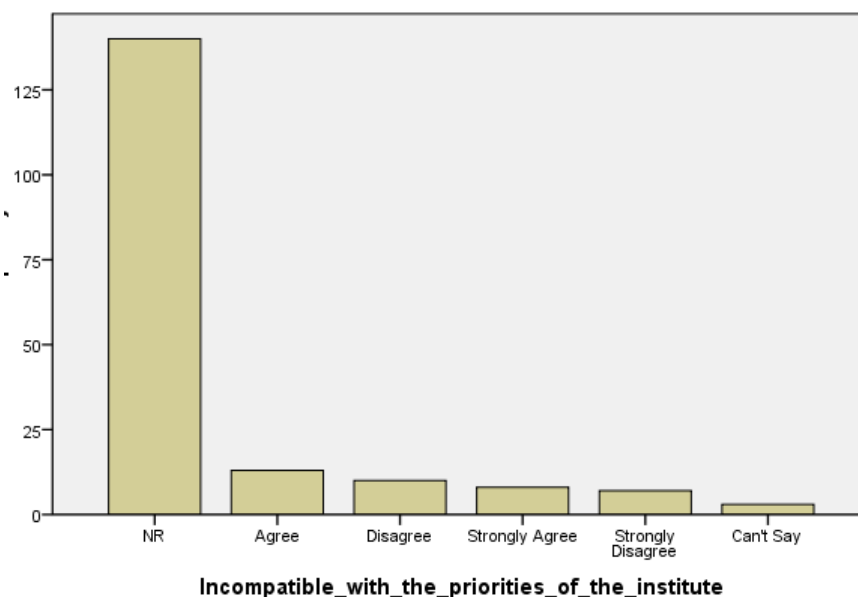


Table 69: Perceptions on the non-suitability of the research problem with the institution’s research mandate - Incompatible with the priorities of the institute

Incompatible with the priorities of the institute	No. of respondents	Percent
Strongly Agree	8	4.4
Agree	13	7.2
Disagree	10	5.5
Strongly Disagree	7	3.9
Can't Say	3	1.7
NR	140	77.3
Total	181	100.0

Fig. 67: Perceptions on the non-suitability of the research problem with the institution’s research mandate - Incompatible with the priorities of the institute



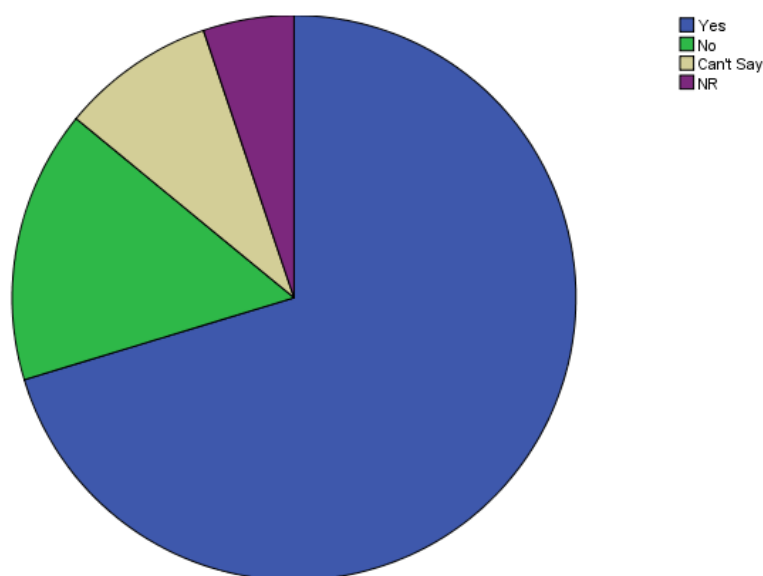
### Interaction with farmers

Crop science research demands constant interaction with farmers. During the green revolution phase plant breeders, agronomists, entomologists and pathologists used to have constant interaction with farmers to know the field problems. The success of green revolution owes much to this kind of intense interaction with farmers. However, with the entry of new generation of scientists who consider agriculture scientist job as a career option the perception on the interaction with farmers has changed. With an intention to know how the scientific community perceives the issue of interaction with farmers, a series of questions were posed to the respondents. Responding to the question ‘does your research require direct interaction with farmers’ majority of the respondents (about 70 percent) stated positively while only 16 percent reported negatively (see Table 70).

Table 70: Interaction with farmers for research

Does your research require direct interaction with farmers?	No. of respondents	Percent
Yes	135	70.3
No	30	15.6
Can't Say	17	8.9
NR	10	5.2
Total	192	100.0

Fig. 68: Interaction with farmers for research



As regards the frequency of interaction with farmers about 41 percent of the respondents suggested that they meet farmers at least once a month while about 27 percent mentioned that they meet farmers once a season (refer Table 71). Intending to know the nature of interaction with farmers a set of questions was asked to the scientists. To the statement that ‘I go to farmers whenever I am in a need to know from them’ a large majority (about 72 percent) of the respondents agreed. The statement ‘farmers come to my office/lab/field’ received agreement from about 51 percent of the respondents. To another statement ‘I interact whenever I go to villages or happen to meet farmers’ received approval from about 70 percent of the respondents. About 63 percent of the respondents observed that they interact with farmers whenever farmers visit the research institution/university on the occasions of kisan mela or exhibition, etc. About 58 percent of the respondents agreed that they contact farmers over phone (See Tables from 72 to 76).

Table 71: Frequency of interaction with farmers for research

Intensity of interaction with farmers for research	No. of respondents	Percent
At least once a month	79	41.1
At least once a season	52	27.1
At least once a year	10	5.2
No interaction with farmers	1	.5
NR	50	26.0
Total	192	100.0

Fig. 69: Frequency of interaction with farmers for research

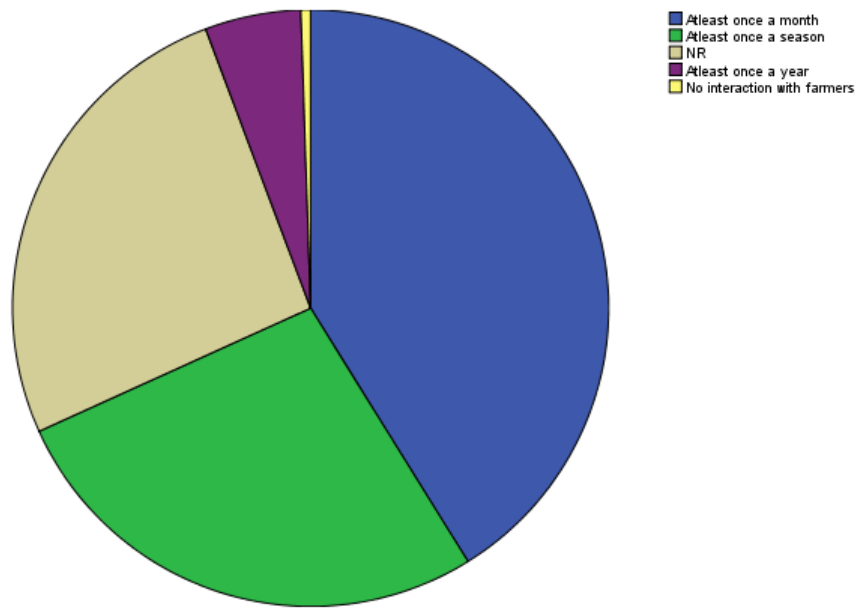


Table 72: Nature of interaction with farmers for research- I go to farmers whenever I am in a need to know from them

I go to farmers whenever I am in a need to know from them	No. of respondents	Percent
Strongly Agree	71	37.0
Agree	68	35.4
Disagree	4	2.1
Can't Say	4	2.1
NR	45	23.4
Total	192	100.0

Fig. 70: Nature of interaction with farmers for research- I go to farmers whenever I am in a need to know from them

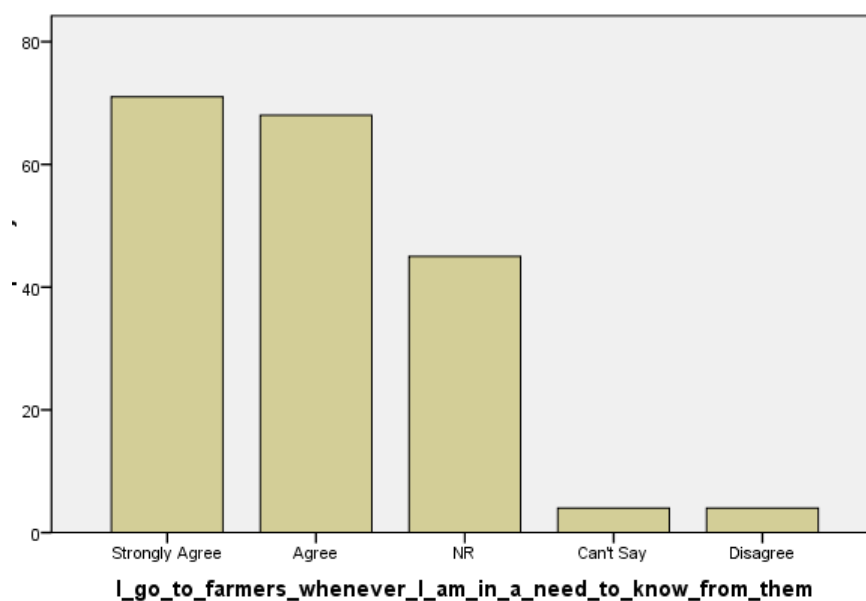


Table 73: Nature of interaction with farmers for research- Farmers come to my office/lab/field

Farmers come to my office/lab/field	No. of respondents	Percent
Strongly Agree	23	12.0
Agree	75	39.1
Disagree	22	11.5
Strongly Disagree	8	4.2
Can't Say	12	6.3
NR	52	27.1
Total	192	100.0

Fig. 71: Nature of interaction with farmers for research- Farmers come to my office/lab/field

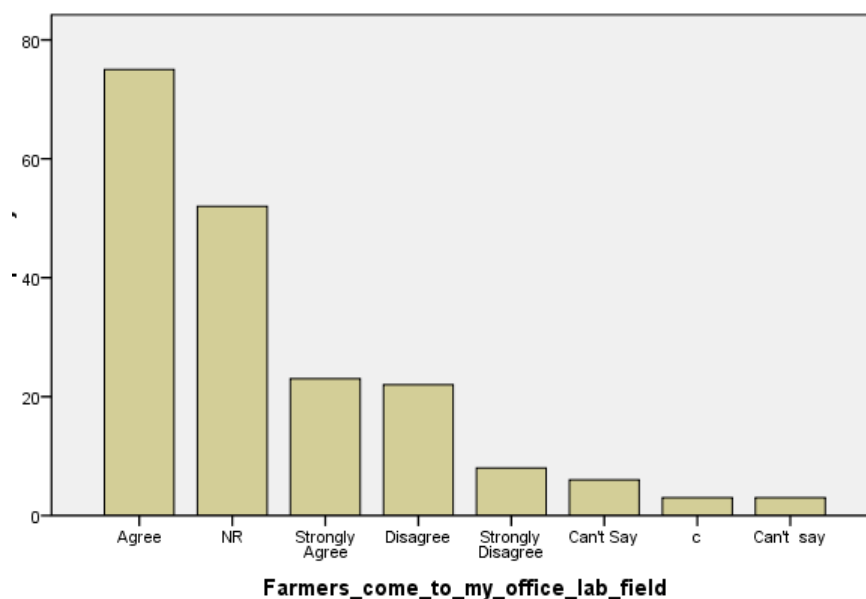


Table 74: Nature of interaction with farmers for research- I interact whenever I go to villages or happen to meet farmers

I interact whenever I go to villages or happen to meet farmers	No. of respondents	Percent
Strongly Agree	54	28.1
Agree	81	42.2
Disagree	6	3.1
Strongly Disagree	3	1.6
Can't Say	6	3.1
NR	42	21.9
Total	192	100.0

Fig. 72: Nature of interaction with farmers for research- I interact whenever I go to villages or happen to meet farmers

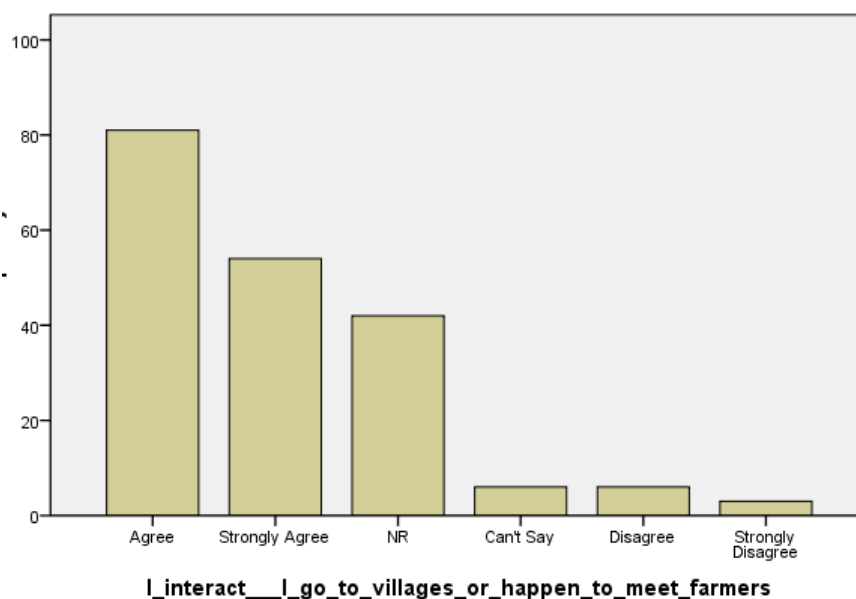


Table 75: Nature of interaction with farmers for research- during kisan mela

I meet farmers when they visit our institution for kisan mela	No. of farmers	Percent
Strongly Agree	59	30.7
Agree	62	32.3
Disagree	4	2.1
Strongly Disagree	3	1.6
Can't Say	14	7.3
NR	50	26.0
Total	192	100.0

Fig. 73: Nature of interaction with farmers for research- during kisan mela

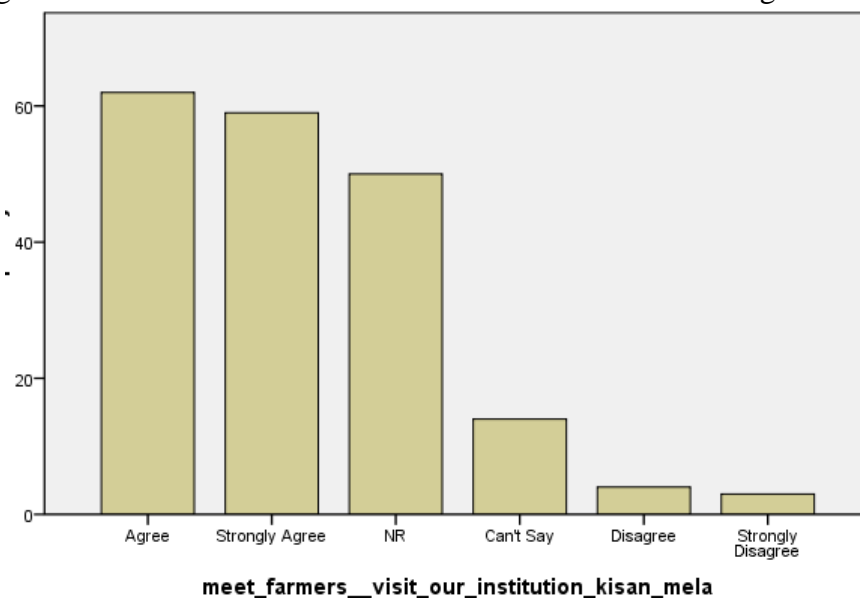
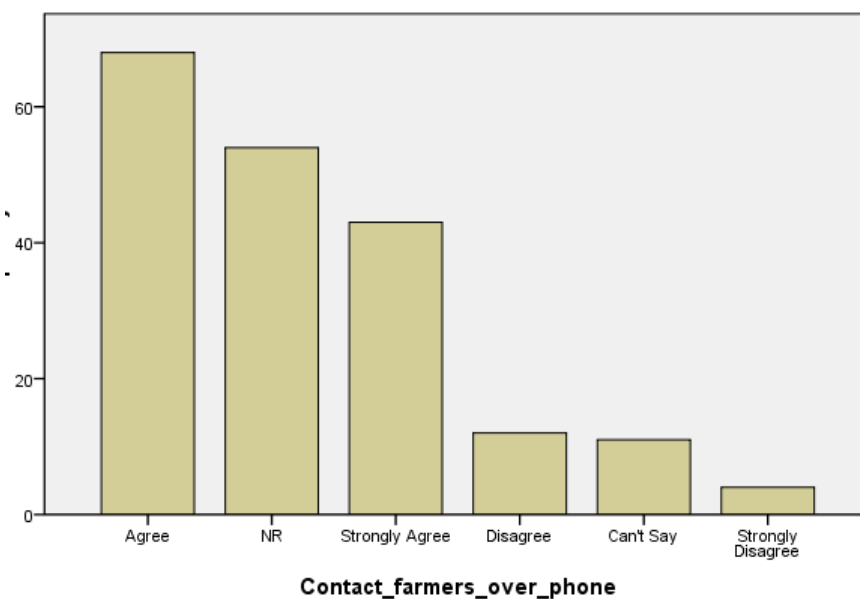


Table 76: Nature of interaction with farmers for research- Contact farmers over phone

Contact farmers over phone	No. of respondents	Percent
Strongly Agree	43	22.4
Agree	68	35.4
Disagree	12	6.2
Strongly Disagree	4	2.1
Can't Say	11	5.7
NR	54	28.1
Total	192	100.0

Fig. 74: Nature of interaction with farmers for research- Contact farmers over phone

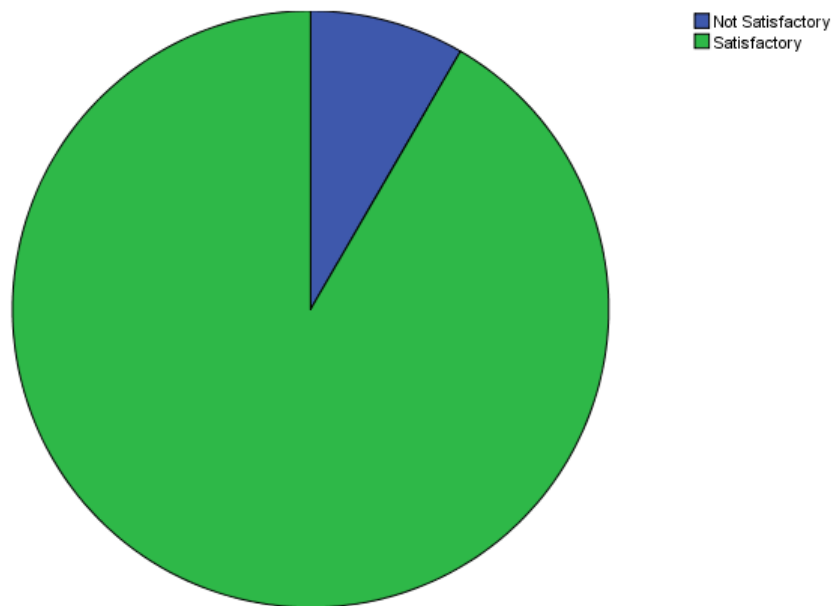


Intending to know the perception of scientists on the nature of interaction with farmers the respondents were asked to rate their interaction with farmers, to which an overwhelming percent (about 92) of the respondents expressed satisfaction while only about 8 percent felt dissatisfied (see Table 77).

Table 77: Feedback on interaction with farmers for research

How do you rate your interaction with farmers?	No. of respondents	Percent
Satisfactory	153	91.6
Not Satisfactory	14	8.4
Total	167	100.0

Fig. 75: Feedback on interaction with farmers for research



Probing further on the outcome of interaction with farmers, the respondents were asked to rate the level of satisfaction against a set of statements. Each statement was rated on a scale of 1 to 5 with one being most satisfactory to five being least satisfactory. Out of 155 scientists who responded 103 (about 67 percent) ranked the statement ‘farmers narrate their problems’ as the most satisfying result of their interaction with famers, 78 scientists (about 50 percent) ranked high satisfaction to the statement ‘I get first hand information’ while 77 scientists (about 50 percent) ranked high satisfaction to the statement ‘I get

inputs for further research'. Data suggest that majority of the scientists give importance to interaction with farmers as the scientists will be able to know the problems of farmers (see Tables 78- to 80).

Table 78: Reasons for satisfactory interaction with farmers for research - Farmers narrate their problems

Farmers narrate their problems ( <i>Rate the answers according to your preference on a scale of 1 to 5. 1 being the most satisfactory to 5 being the least satisfactory</i> )	No. of respondents	Percent
1	103	66.5
2	31	20.0
3	7	4.5
4	5	3.2
NR	9	5.8
Total	155	100.0

Fig. 76: Reasons for satisfactory interaction with farmers for research- Farmers narrate their problems

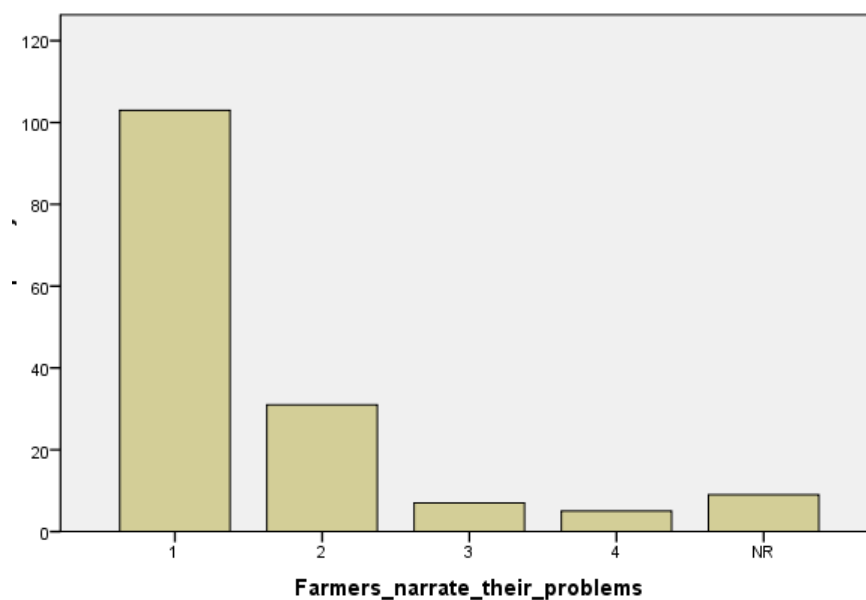


Table 79: Reasons for satisfactory interaction with farmers for research - I get first hand information

I get first hand information (Rate the answers according to your preference on a scale of 1 to 5. 1 being the most satisfactory to 5 being the least satisfactory)	No. of respondents	Percent
1	78	50.3
2	50	32.3
3	14	9.0
4	2	1.3
5	3	1.9
NR	8	5.2
Total	155	100.0

Fig. 77: Reasons for satisfactory interaction with farmers for research - I get first hand information

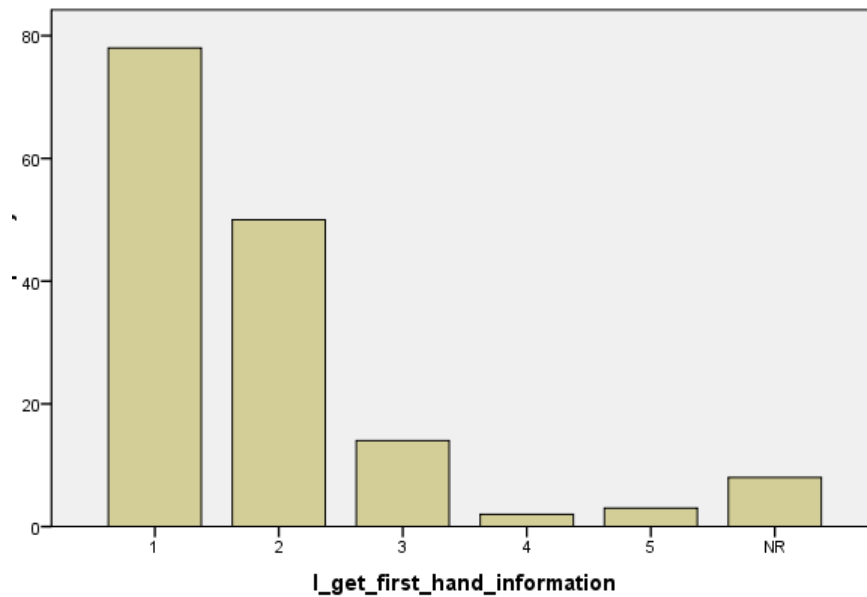
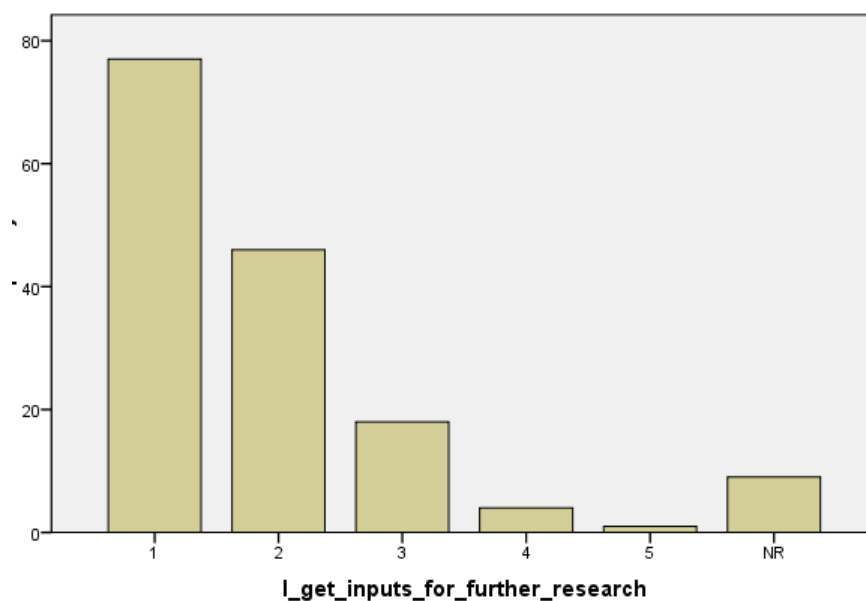


Table 80: Reasons for satisfactory interaction with farmers for research - I get inputs for further research

I get inputs for further research ( <i>Rate the answers according to your preference on a scale of 1 to 5. 1 being the most satisfactory to 5 being the least satisfactory</i> )	No. of respondents	Percent
1	77	49.7
2	46	29.7
3	18	11.6
4	4	2.6
5	1	.6
NR	9	5.8
Total	155	100.0

Fig. 78: Reasons for satisfactory interaction with farmers for research - I get inputs for further research



Intending to know the stage at which scientists prefer to interact with farmers for research purpose data were collected against a set of predetermined statements on a three point scale ranging from most preferable to the least preferable. Out of 193 scientists who responded to the question 121 (about 63 percent) mentioned the research problem formulation stage as the most preferable stage of interaction with farmers. Only about 33 percent mentioned the end stage to conduct field demonstration while for about 36 percent

respondents the most preferred stage of interaction was throughout the experiment stage (see Tables 81 to 83).

Table 81: Preferred stage of interaction with farmers for research - At the research problem formulation stage

At the research problem formulation stage	No. of respondents	Percent
Most Preferable	121	62.7
Preferable	37	19.2
Least Preferable	6	3.1
NR	29	15.0
Total	193	100.0

Fig. 79: Preferred stage of interaction with farmers for research - At the research problem formulation stage

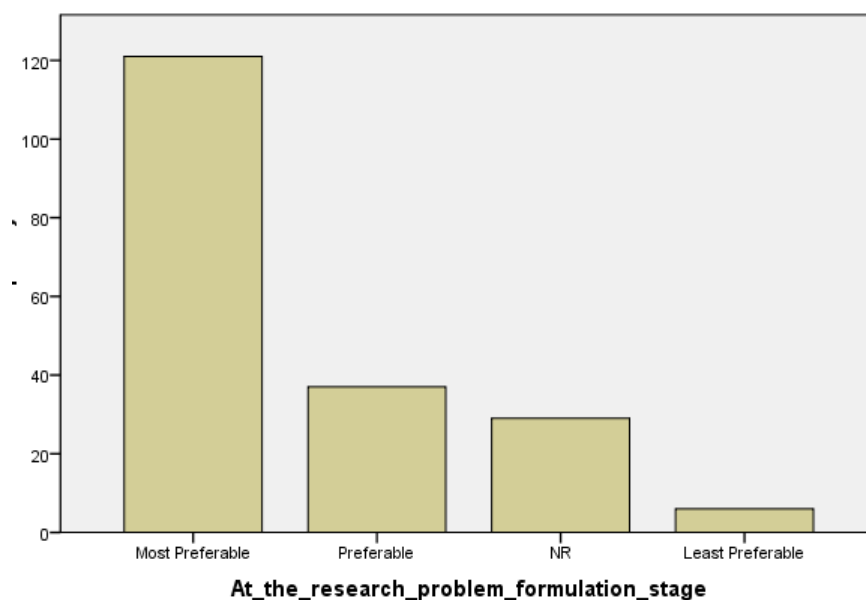


Table 82: Preferred stage of interaction with farmers for research - At the end stage to conduct field trial/demonstration

At the end stage to conduct field trial/demonstration	No. of respondents	Percent
Most Preferable	37	19.2
Preferable	64	33.2
Least Preferable	52	26.9
NR	40	20.7
Total	193	100.0

Fig. 80: Preferred stage of interaction with farmers for research - At the end stage to conduct field trial/demonstration

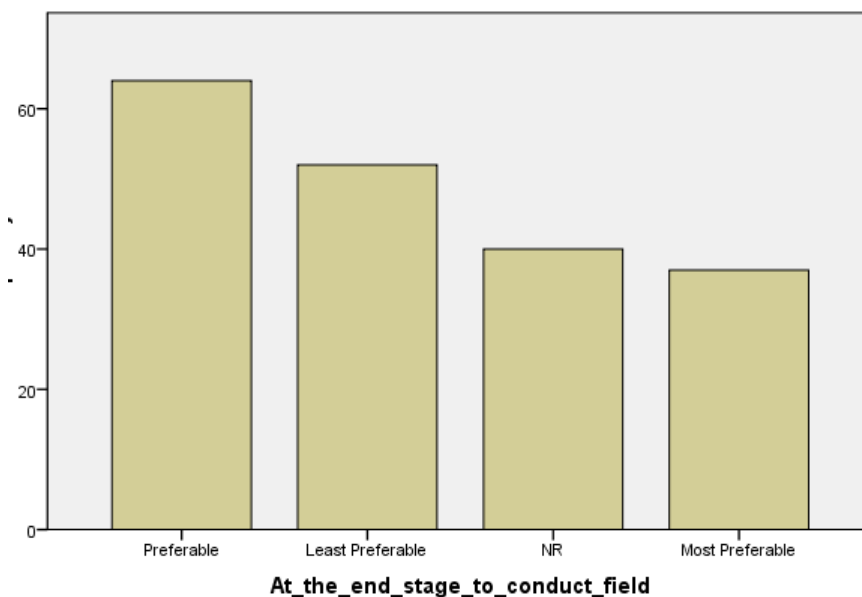
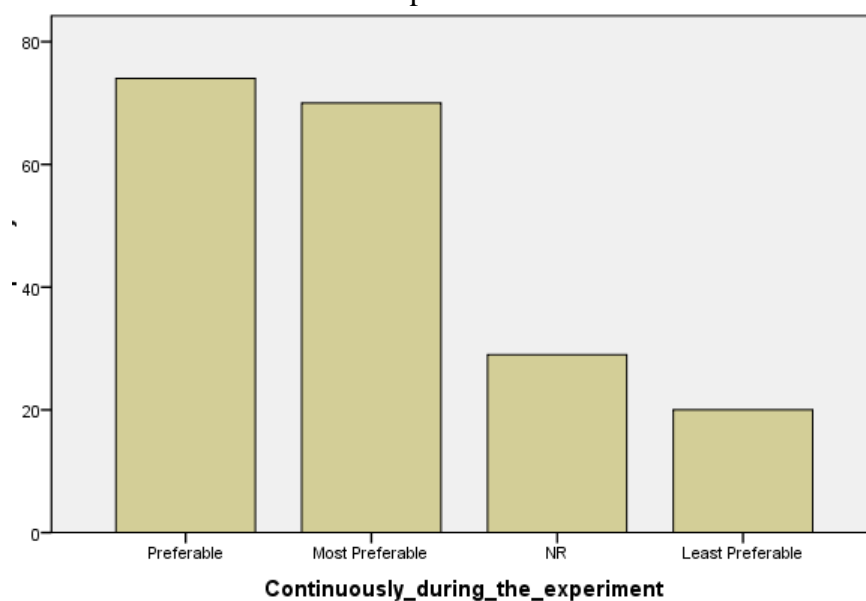


Table 83: Preferred stage of interaction with farmers for research - Continuously during the experiment

Continuously during the experiment	No. of respondents	Percent
Most Preferable	70	36.3
Preferable	74	38.3
Least Preferable	20	10.4
NR	29	15.0
Total	193	100.0

Fig. 81: Preferred stage of interaction with farmers for research - Continuously during the experiment



To understand the perception of scientists on farmers, a set of questions was asked. Against each statement the scientists were asked to respond on a continuum of agreement with the given statement. Out of 178 scientists who responded to the question about 49 percent agreed to the statement that farmers are enthusiastic to learn while about 33 percent strongly agreed. A large majority i.e. about 87 percent were in agreement with the statement that farmers receive new knowledge from scientists. Only about 19 percent agreed with the statement that farmers are not interested in agriculture while about 58 percent were in disagreement. Responding to the statement that farmers are interested only in the inputs given free of cost about 43 percent agreed while about 30 percent were non committal. To the statement that farmers are not enthusiastic to seek advices from scientists about 57 percent scientists responded negatively implying that farmers are enthusiastic (see Table 84 to 88).

Table 84: Perceptions of agricultural scientists on farmers - enthusiastic to learn

Farmers are enthusiastic to learn	No. of respondents	Percent
Strongly Agree	59	33.1
Agree	88	49.4
Disagree	5	2.8
Strongly Agree	3	1.7
Can't say	20	11.3
NR	3	1.7
Total	178	100.0

Fig. 82: Perceptions of agricultural scientists on farmers - enthusiastic to learn

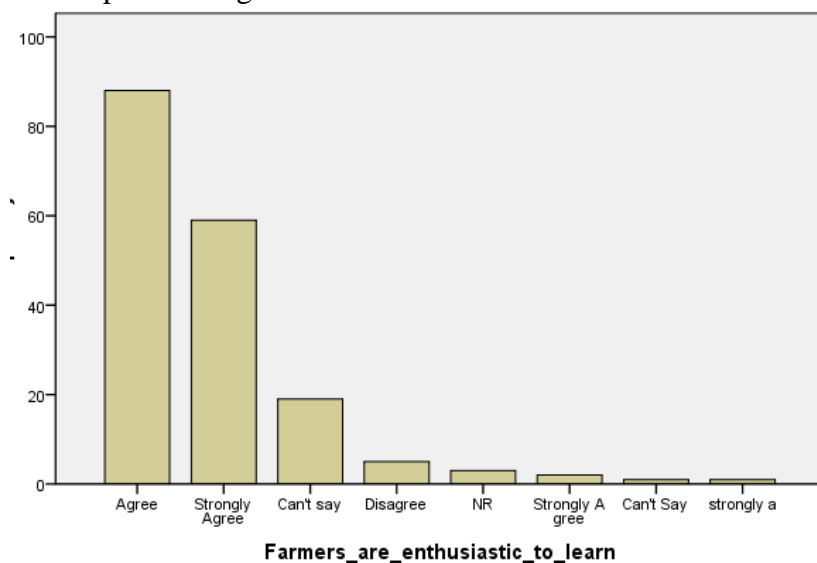


Table 85: Perceptions of agricultural scientists on farmers – they receive new knowledge from scientists

Farmers receive new knowledge from scientists	No. of respondents	Percent
Strongly Agree	52	29.2
Agree	102	57.3
Disagree	1	.6
Can't Say	13	7.3
NR	10	5.6
Total	178	100.0

Fig. 83: Perceptions of agricultural scientists on farmers – they receive new knowledge from scientists

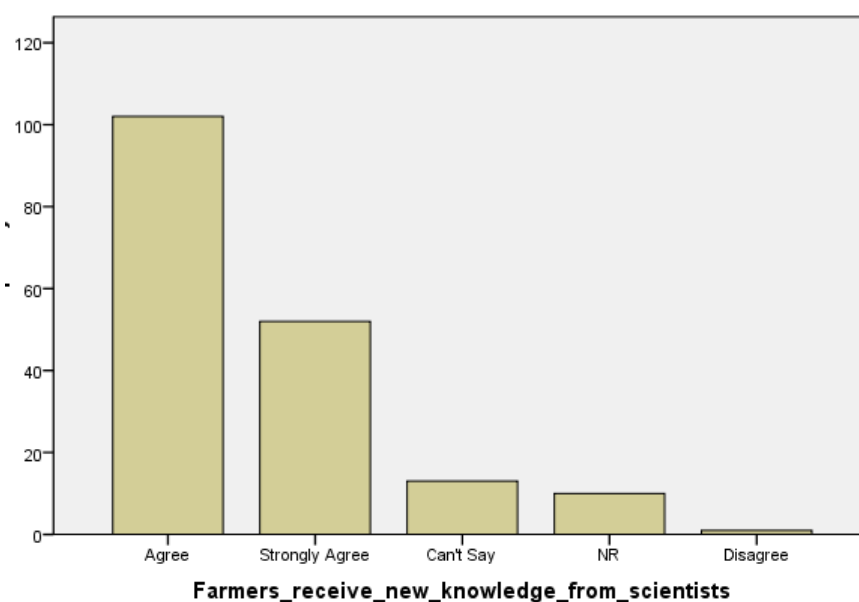


Table 86: Perceptions of agricultural scientists on farmers – they are not interested in agriculture

Farmers are not interested in agriculture	No. of respondents	Percent
Strongly Agree	4	2.2
Agree	30	16.9
Disagree	72	40.4
Strongly Disagree	32	18.0
Can't Say	28	15.7
NR	12	6.7
Total	178	100.0

Fig. 84: Perceptions of agricultural scientists on farmers – they are not interested in agriculture

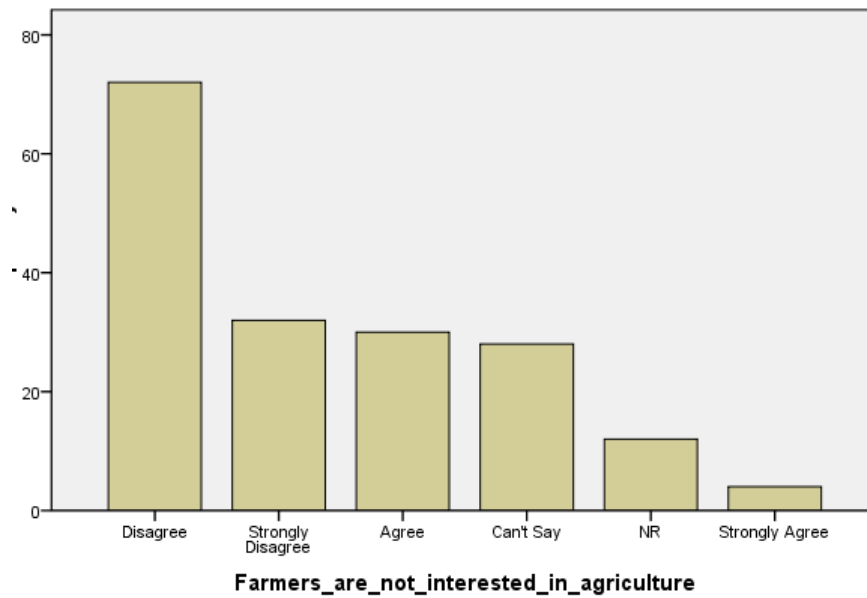


Table 87: Perceptions of agricultural scientists on farmers – they are interested only in the inputs given free of cost

Farmers are interested only in the inputs given free of cost	No. of respondents	Percent
Strongly Agree	18	10.1
Agree	58	32.6
Disagree	36	20.2
Strongly Disagree	12	6.7
Can't Say	46	25.8
NR	8	4.5
Total	178	100.0

Fig. 85: Perceptions of agricultural scientists on farmers – they are interested only in the inputs given free of cost

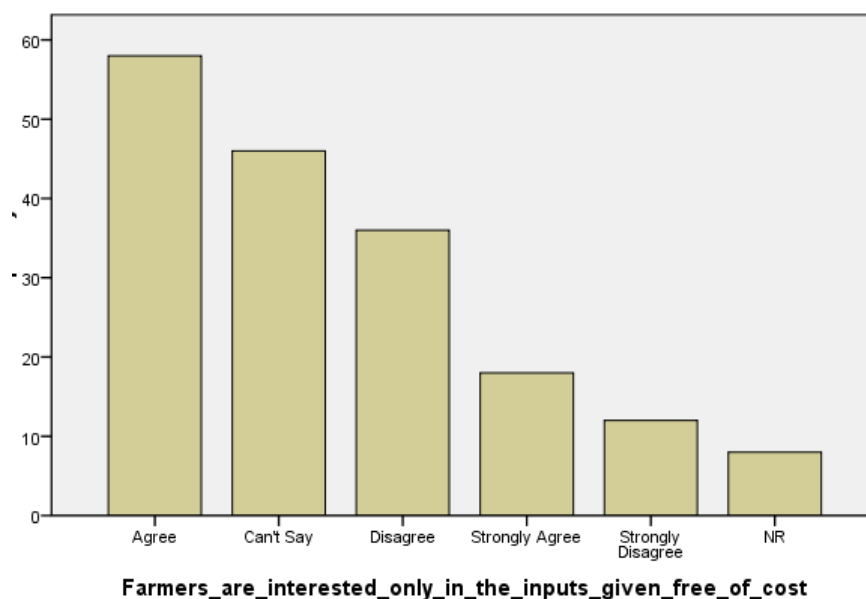
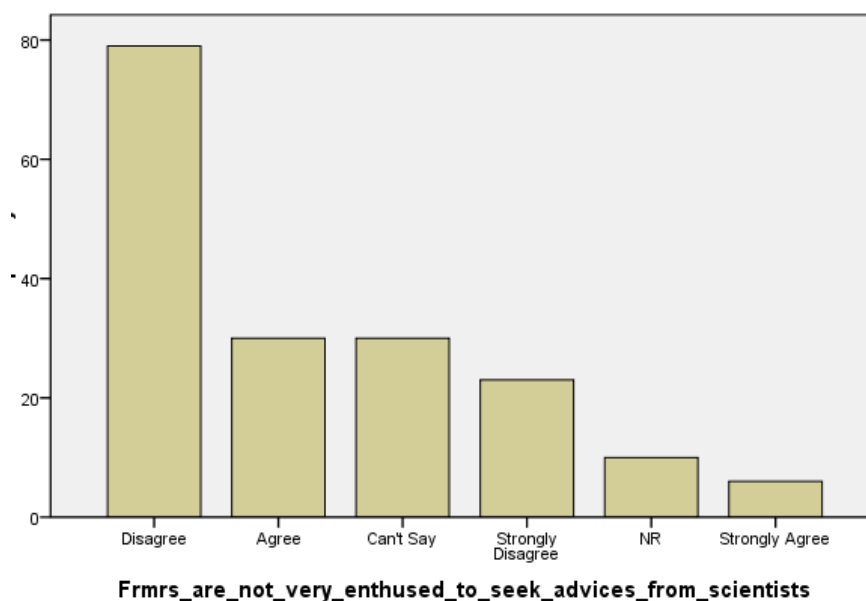


Table 88: Perceptions of agricultural scientists on farmers – they are not very enthused to seek advices from scientists

Farmers are not very enthused to seek advices from scientists	No. of respondents	Percent
Agree	30	16.9
Strongly Agree	6	3.4
Disagree	79	44.4
Strongly Disagree	23	12.9
Can't Say	30	16.9
NR	10	5.6
Total	178	100.0

Fig. 86: Perceptions of agricultural scientists on farmers – they are not very enthused to seek advices from scientists

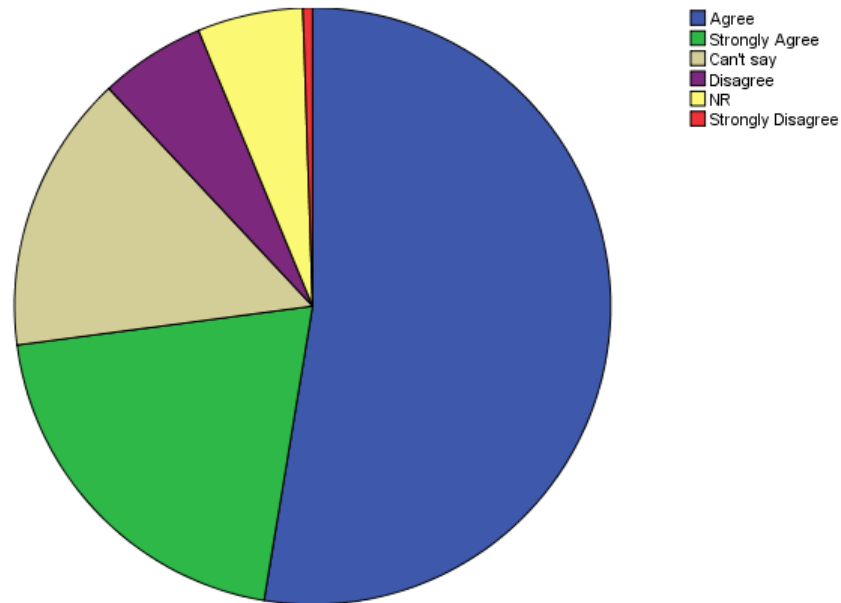


To what extent farmers take scientists suggestions seriously? Intending to know the scientists’ opinion on this the statement ‘farmers take scientists’ suggestions seriously’ was given to the scientists to which about 73 percent agreed.

Table 89: Perceptions of agricultural scientists on farmers – they take scientists suggestions seriously

Farmers take scientists suggestions seriously	No. of respondents	Percent
Strongly Agree	39	20.3
Agree	101	52.6
Disagree	11	5.7
Strongly Disagree	1	0.5
Can't say	29	15.1
NR	11	5.7
Total	192	100.0

Fig. 87: Perceptions of agricultural scientists on farmers – they take scientists suggestions seriously



Feedback from farmers is important in the research process. Agricultural scientists endeavour to contact farmers and hear their problems first hand. Field visits provide such opportunity. However, due to several reasons, in the present context, the contact between farmers and scientists has become rare and ritualistic. Intending to know what sources scientists would rely on getting feedback from farmers a question was posed. Out of 181 scientists who responded, about 76 percent preferred approaching farmers directly most (see Table 90). At the next level, the preferred source is state department of agriculture (about 29 percent) followed by farmers giving feedback directly to the scientists (about 27 percent) (see Table 91). Data suggest that the least preferred source for obtaining feedback from framers is through local leaders (about 42 percent) followed by state department personnel (about 24 percent, see Table 92).

Table 90: Source of feedback from farmers - Most preferred source

Most preferred source	No. of respondents	Percent
Directly approach farmers	138	76.2
State department personnel help you to reach out to farmers	19	10.5
Farmers give you feedback directly	17	9.4
Rely on local leaders to reach out to farmers	2	1.1
NR	5	2.8
Total	181	100.0

Fig. 88: Source of feedback from farmers - Most preferred source

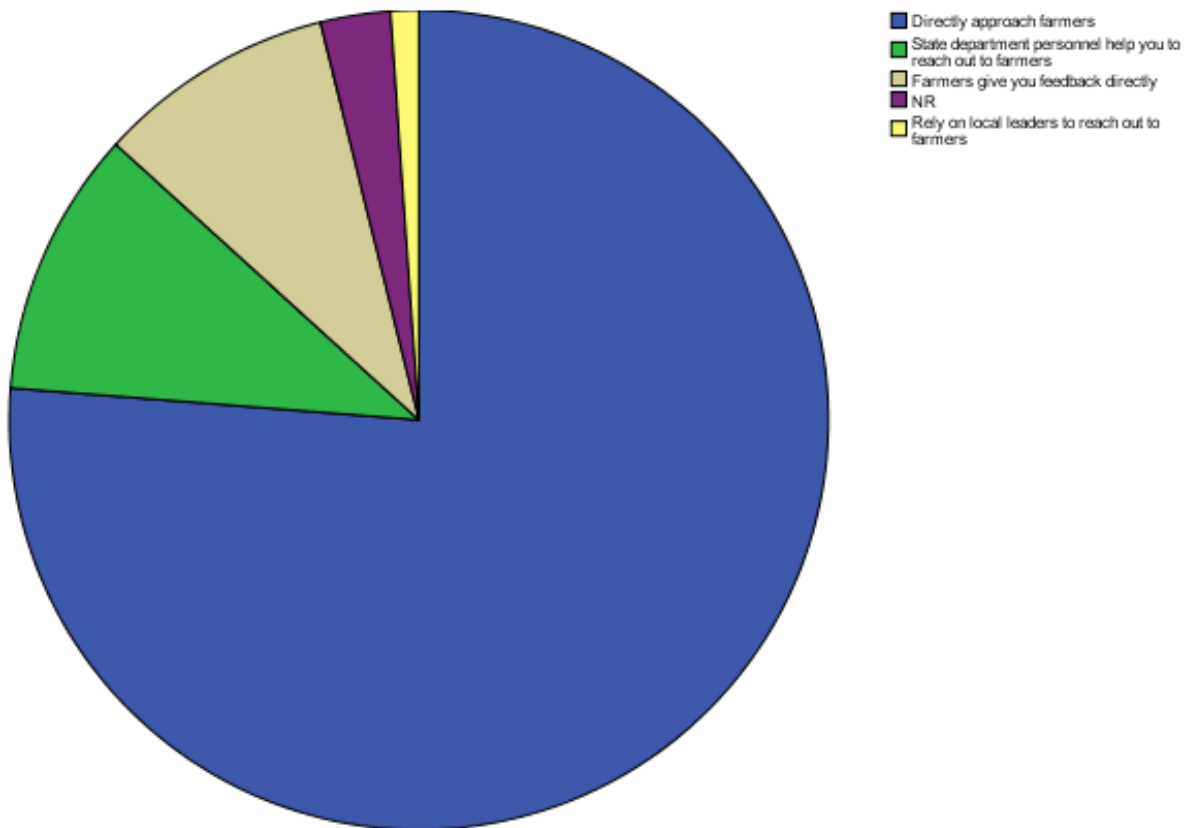


Table 91: Source of feedback from farmers - Preferred source

Preferred source	No. of respondents	Percent
State department personnel help you to reach out to farmers	52	28.7
Farmers give you feedback directly	49	27.1
Directly approach farmers	28	15.5
Rely on local leaders to reach out to farmers	15	8.3
NR	37	20.4
Total	181	100.0

Fig. 89: Source of feedback from farmers - Preferred source

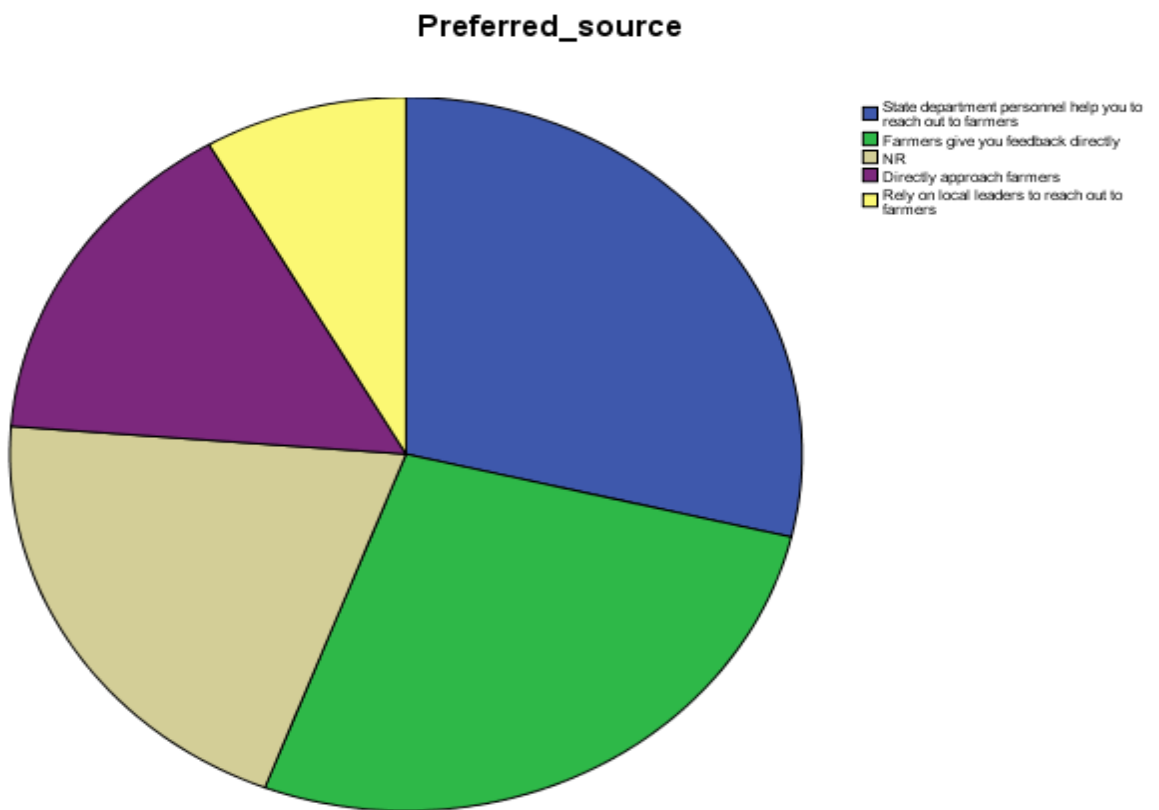
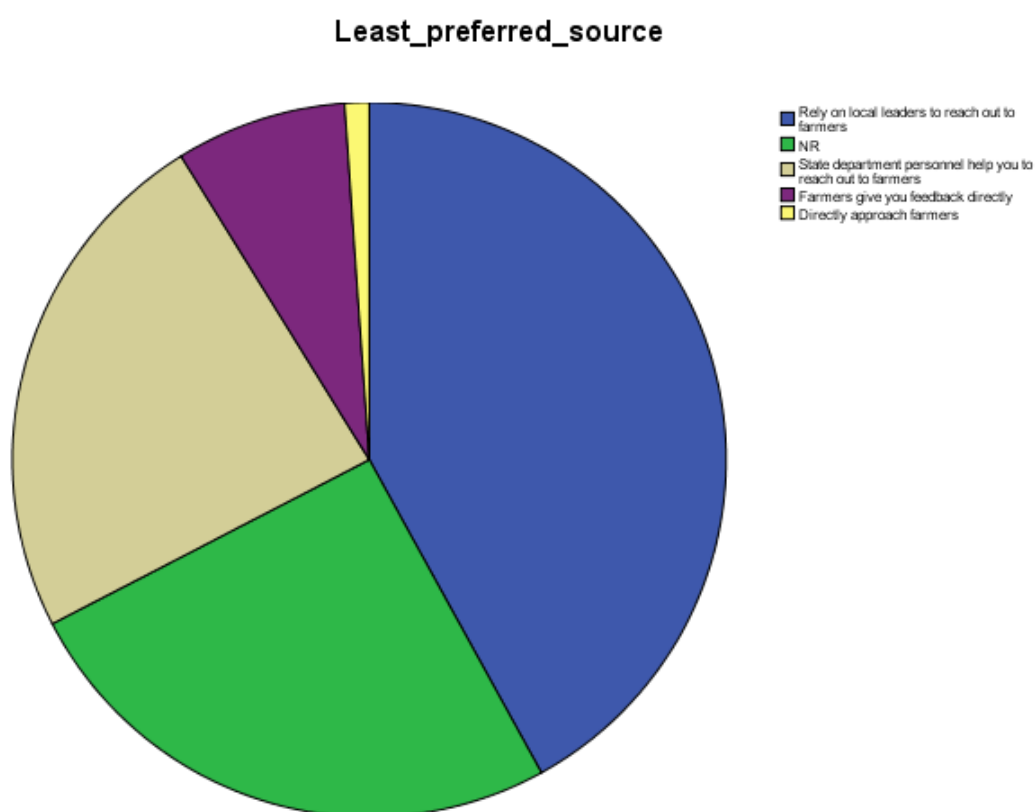


Table 92: Source of feedback from farmers – Least preferred source

Least preferred source	No. of respondents	Percent
Rely on local leaders to reach out to farmers	76	42.0
State department personnel help you to reach out to farmers	43	23.8
Farmers give you feedback directly	14	7.7
Directly approach farmers	2	1.1
NR	46	25.4
Total	181	100.0

Fig. 90: Source of feedback from farmers – Least preferred source



### Reflections on contemporary agriculture in the country

It is a well known fact that the contemporary agriculture is undergoing tremendous changes owing to several reasons located in agriculture and also in the wider social

context. Changes in the agricultural practices in terms of new types of inputs, mechanization, etc, have impacted the agriculture scenario in the country. Alongside, the social organization of agriculture in India witnessed changes in terms of the profile of farmers, nature of markets, inputs, etc. The new generation currently engaged in agriculture is different from that of green revolution era. Given this context, the present study attempted to know the perceptions of agricultural scientists on the priorities of agriculture research today. A set of statements was given to the scientists and their responses were recorded on a six point scale ranging from most relevant to least relevant.

Responding to the statement that agricultural scientists need to look for productivity increasing research outcomes, about 55 percent of the scientists considered it as most relevant (see Table 93). On the need for efficiency increasing research outcomes about 38 percent found it most relevant (see Table 94). Data on the need for environmental friendly research as a priority of agricultural scientists in the today’s context reveal that about 40 percent consider it as most relevant (see Table 95). About 44 percent of the respondents considered sustainable research outcomes as the most relevant for agricultural science research today (see Table 96). Interestingly only about 37 percent of the respondents considered that small and marginal farmer friendly research outcomes as most relevant (see Table 97). A significant number i.e. about 9 percent considered it as the least relevant. Similarly responding to the statement that agricultural scientists need to look for economically viable research outcomes about 47 percent considered it as most relevant while about 9 percent considered it as the least relevant (see Table 98).

Table 93: Need of the hour for agricultural science research in the country- productivity increasing research outcomes

Need productivity increasing research outcomes ( <i>Ranks in the order of relevance from 1 to 6. 1 being the most relevant and 6 being the least relevant option</i> )	No. of respondents	Percent
1	102	55.4
2	31	16.8
3	15	8.2
4	7	3.8
5	9	4.9
6	13	7.1
NR	7	3.8
Total	184	100.0

Fig. 91: Need of the hour for agricultural science research in the country- productivity increasing research outcomes

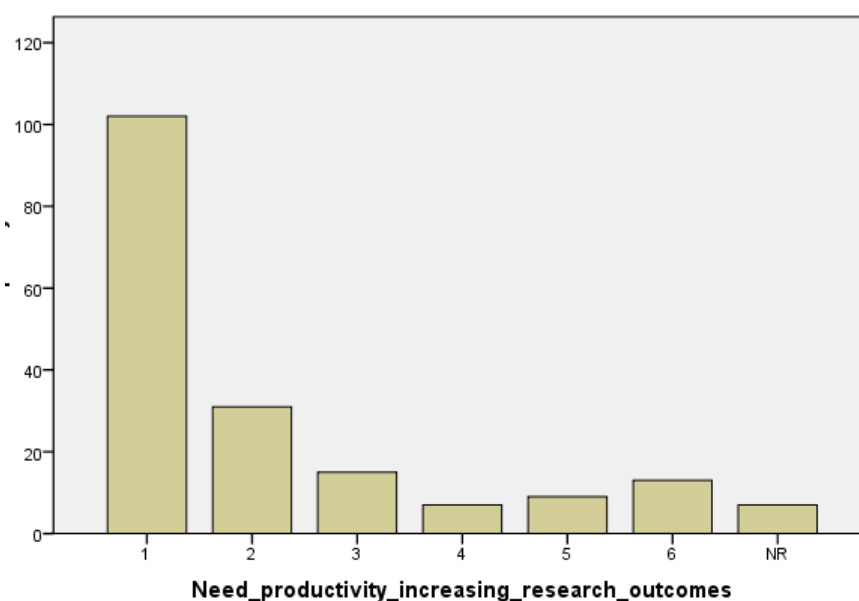


Table 94: Need of the hour for agricultural science research in the country- Need efficiency increasing research outcomes

Need efficiency increasing research outcomes (Ranks in the order of relevance from 1 to 6. 1 being the most relevant and 6 being the least relevant option)	No. of respondents	Percent
1	70	38.0
2	47	25.5
3	13	7.1
4	10	5.4
5	15	8.2
6	15	8.2
NR	14	7.6
Total	184	100.0

Fig. 92: Need of the hour for agricultural science research in the country- Need efficiency increasing research outcomes

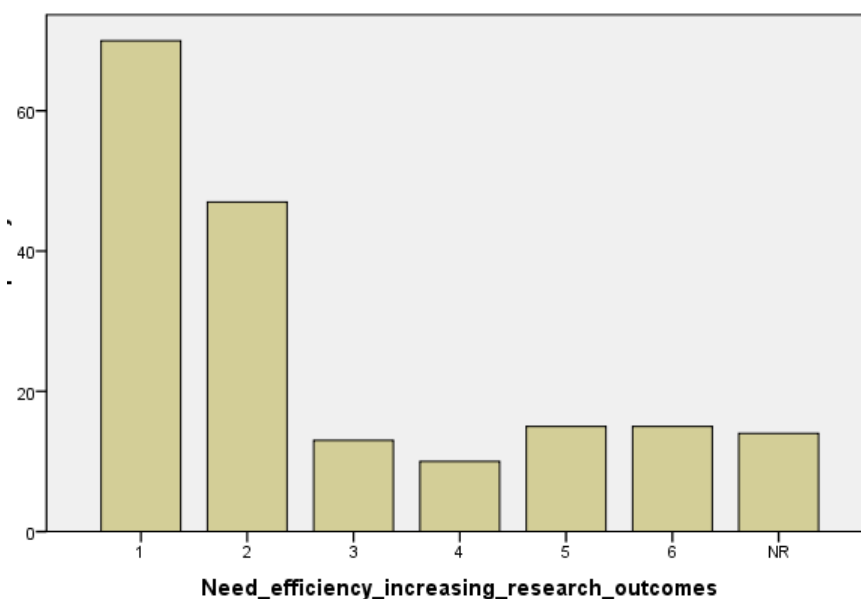


Table 95: Need of the hour for agricultural science research in the country- Need environment friendly research outcomes

Need environment friendly research outcomes ( <i>Ranks in the order of relevance from 1 to 6. 1 being the most relevant and 6 being the least relevant option</i> )	No. of respondents	Percent
1	73	39.7
2	39	21.2
3	27	14.7
4	17	9.2
5	10	5.4
6	7	3.8
NR	11	6.0
Total	184	100.0

Fig. 93: Need of the hour for agricultural science research in the country- Need environment friendly research outcomes

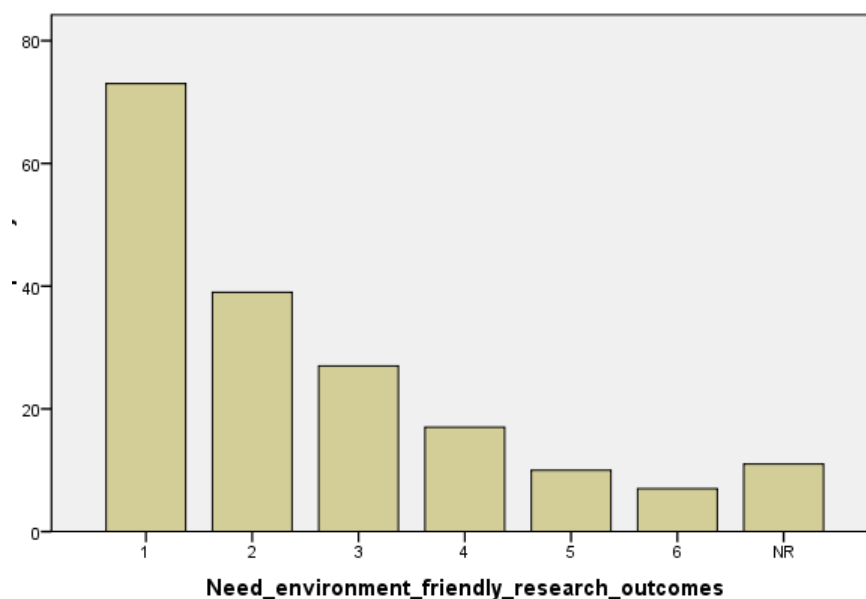


Table 96: Need of the hour for agricultural science research in the country- Need sustainable research outcomes

Need sustainable research outcomes ( <i>Ranks in the order of relevance from 1 to 6. 1 being the most relevant and 6 being the least relevant option</i> )	No. of respondents	Percent
1	80	43.5
2	49	26.6
3	23	12.5
4	13	7.1
5	6	3.3
6	5	2.7
NR	8	4.3
Total	184	100.0

Fig. 94: Need of the hour for agricultural science research in the country- Need sustainable research outcomes

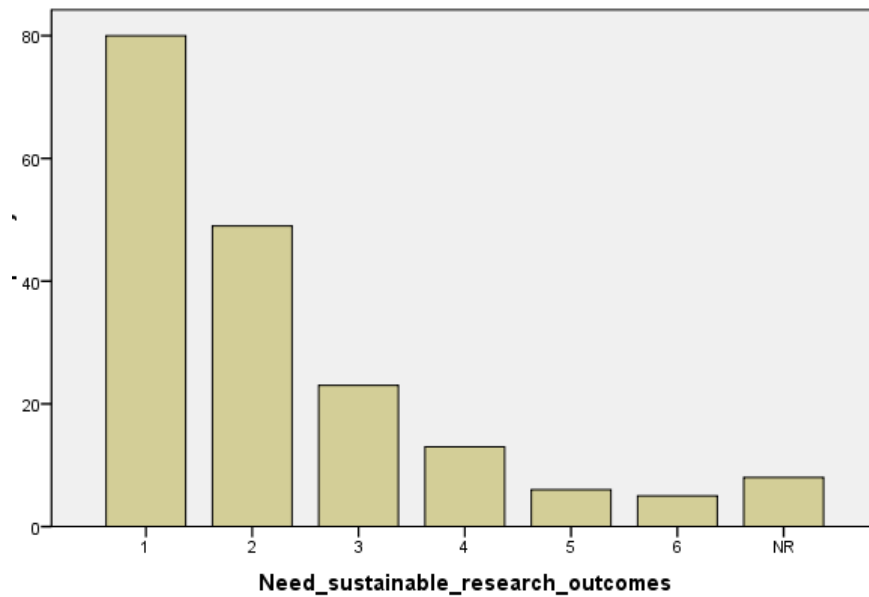


Table 97: Need of the hour for agricultural science research in the country- Need small and marginal farmer friendly research outcomes

Need small and marginal farmer friendly research outcomes ( <i>Ranks in the order of relevance from 1 to 6. 1 being the most relevant and 6 being the least relevant option</i> )	No. of respondents	Percent
1	68	37.0
2	47	25.5
3	14	7.6
4	16	8.7
5	13	7.1
6	16	8.7
NR	10	5.4
Total	184	100.0

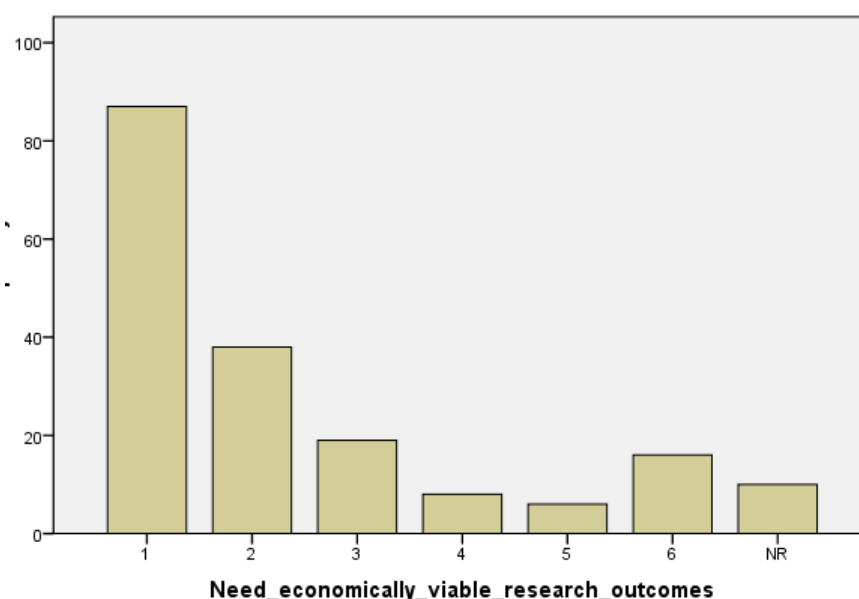
Fig. 95: Need of the hour for agricultural science research in the country- Need small and marginal farmer friendly research outcomes



Table 98: Need of the hour for agricultural science research in the country- Need economically viable research outcomes

Need economically viable research outcomes ( <i>Ranks in the order of relevance from 1 to 6. 1 being the most relevant and 6 being the least relevant option</i> )	No. of respondents	Percent
1	87	47.3
2	38	20.7
3	19	10.3
4	8	4.3
5	6	3.3
6	16	8.7
NR	10	5.4
Total	184	100.0

Fig. 96: Need of the hour for agricultural science research in the country- Need economically viable research outcomes



State played an important role in the success of green revolution. Several institutions of research under the state control contributed their best towards overcoming the food crisis in the country by helping farmers to realize higher yields and productivity. However, over the years, post globalization, the role of state in agriculture in general and agriculture science research in particular, has been declining. Similarly the role of agricultural scientists of state institutions is declining as a result of opening up of agricultural input market to private players. There is also a general perception that the gap between scientific practices advised by scientists and the field practices followed by farmers is wide.

Intending to know how agricultural scientists view this scenario a set of questions was asked. Responding to the first statement that ‘scientists have no role in taking the research findings to farmers’ about 61 percent disagreed (see Table 99). As regards the perceptions of scientists about the state’s role in taking the research findings to farmers about 47 percent agreed that state has to take the findings to farmers (see Table 100). Responding to the statement that state should withdraw from agriculture a large majority, i.e. about 79 percent disagreed (see Table 101).

Table 99: Perceptions of scientists on taking the research findings to farmers

Scientists have no role in taking the research findings to farmers ( <i>Rank in the order of your agreement from 1 to 3. 1 being the most agreeable and 3 being the least agreeable</i> )	No. of respondents	Percent
1	17	9.2
2	47	25.5
3	113	61.4
NR	7	3.8
Total	184	100.0

Fig. 97: Perceptions of scientists on taking the research findings to farmers

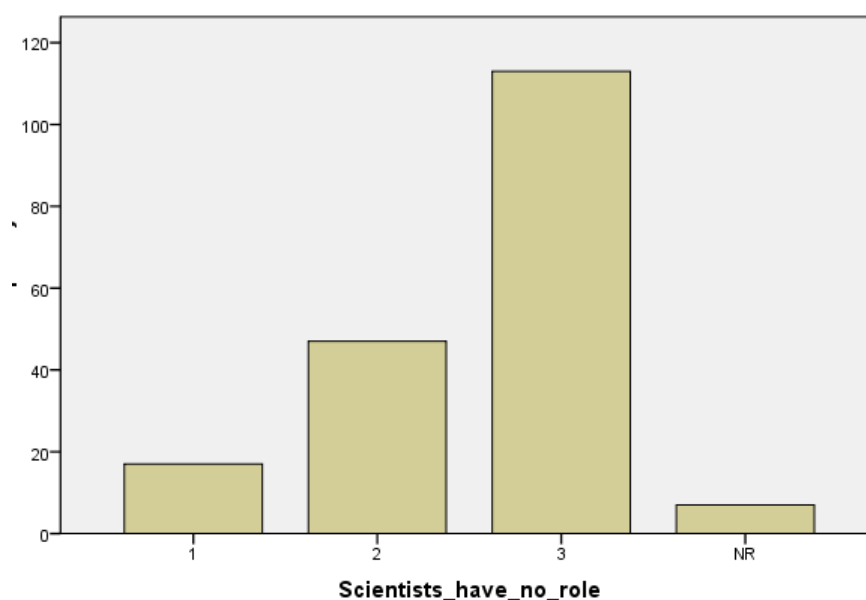


Table 100: Perceptions of scientists - State has to take the research findings to farmers

State has to take the research findings to farmers ( <i>Rank in the order of your agreement from 1 to 3. 1 being the most agreeable and 3 being the least agreeable</i> )	No. of respondents	Percent
1	87	47.3
2	55	29.9
3	34	18.5
NR	8	4.3
Total	184	100.0

Fig. 98: Perceptions of scientists - State has to take the research findings to farmers

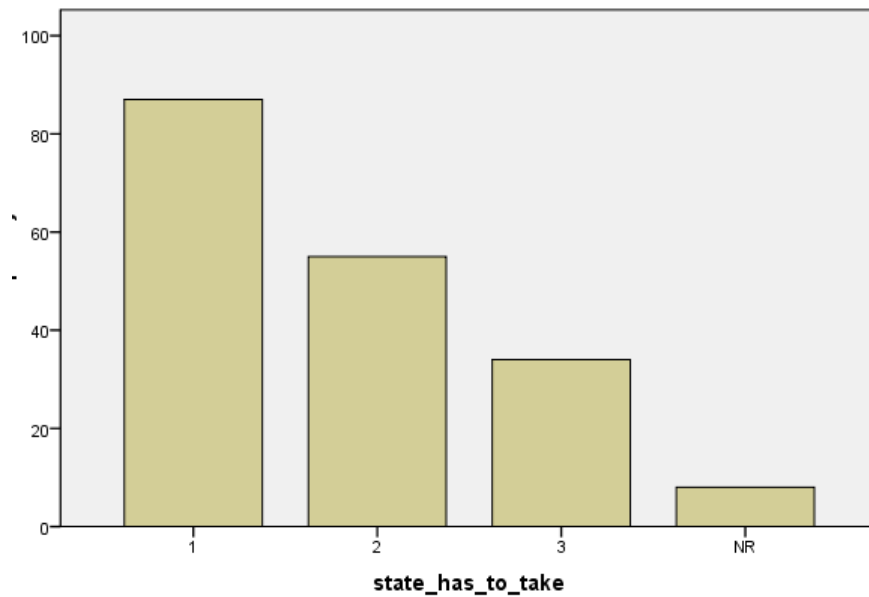
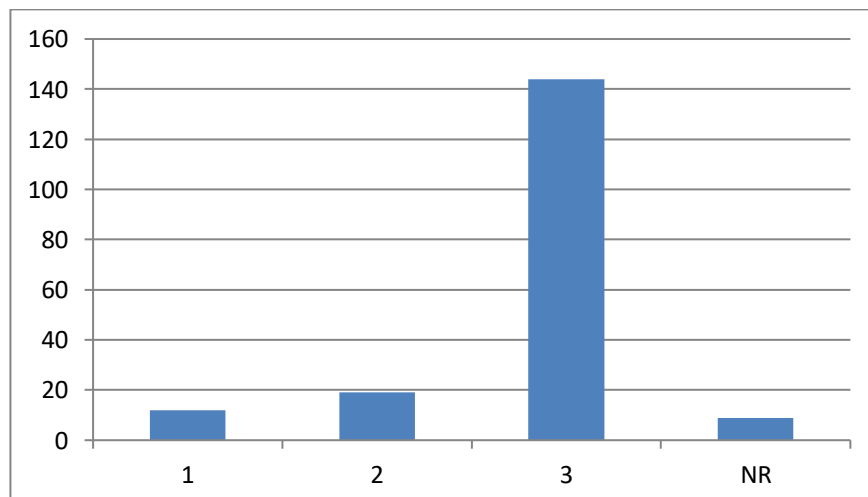


Table 101: Perceptions of scientists - State should withdraw from agriculture

State should withdraw from agriculture (Rank in the order of your agreement from 1 to 3. 1 being the most agreeable and 3 being the least agreeable)	No. of respondents	Percent
1	12	6.5
2	19	10.3
3	144	78.2
NR	9	4.9
Total	184	100.0

Fig. 99: Perceptions of scientists - State should withdraw from agriculture



When asked to respond to the statements pertaining to the role of the state in agriculture in general, an overwhelming majority of the respondents (about 96 percent) agreed with the statement that state should have a greater role in agriculture (see Table 102). About 47 percent of the respondents disagreed with the statement that the state should limit to regulating private affairs (see Table 103). Interestingly about 41 percent agreed with the same statement indicating that a significant number of scientists want private players to have a role in agriculture in the country. However, to the statement that the state should leave agriculture to the market forces a large number of respondents, i.e. 74 percent, disagreed (see Table 104).

Table 102: Perceptions of scientists –state should have a greater role in agriculture

Government should play an active role	No. of respondents	Percent
Yes	175	96.2
No	5	2.7
NR	2	1.1
Total	182	100.0

Fig. 100: Perceptions of scientists –state should have a greater role in agriculture

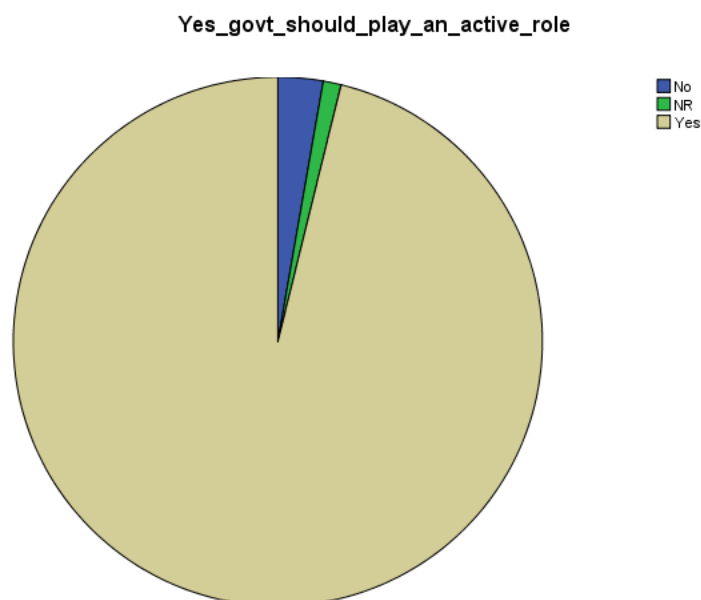


Table 103: Perceptions of scientists –state should limit to regulating private efforts

Government should limit to regulating private efforts	No. of respondents	Percent
Yes	75	41.2
No	85	46.7
NR	22	12.1
Total	182	100.0

Fig. 101: Perceptions of scientists - State should limit to regulating private efforts

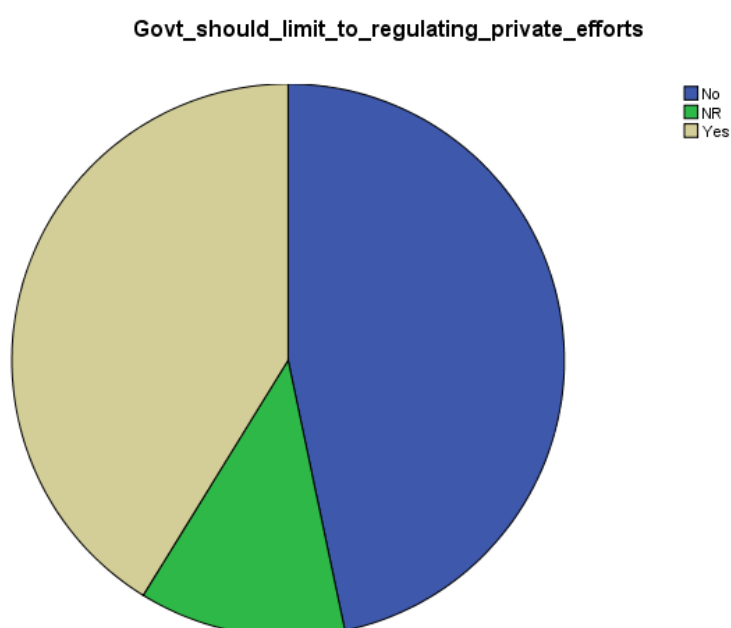
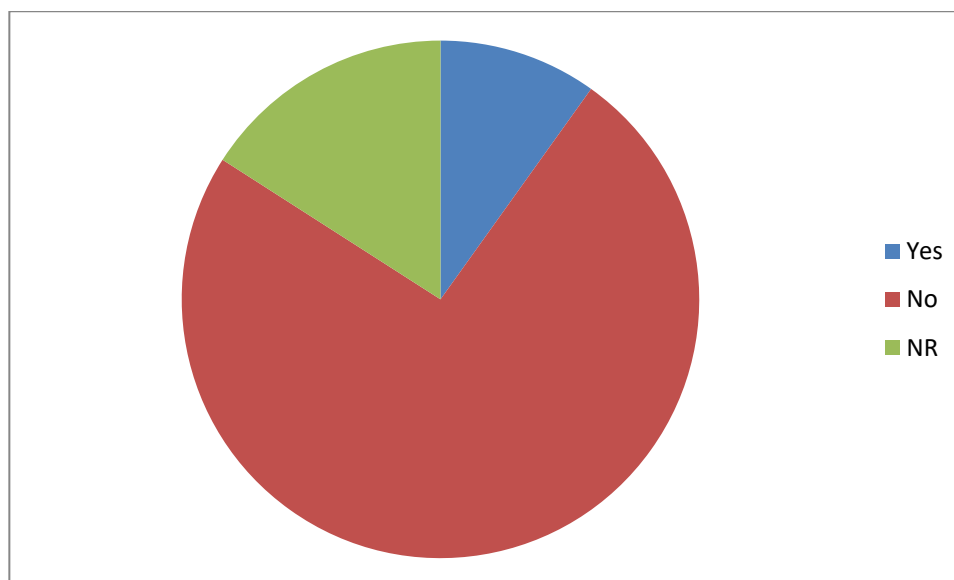


Table 104: Perceptions of scientists –state should leave agriculture to the market forces

State should leave agriculture to the market forces	No. of respondents	Percent
Yes	18	9.9
No	135	74.1
NR	29	15.9
Total	182	100.0

Fig. 102: Perceptions of scientists –state should leave agriculture to the market forces

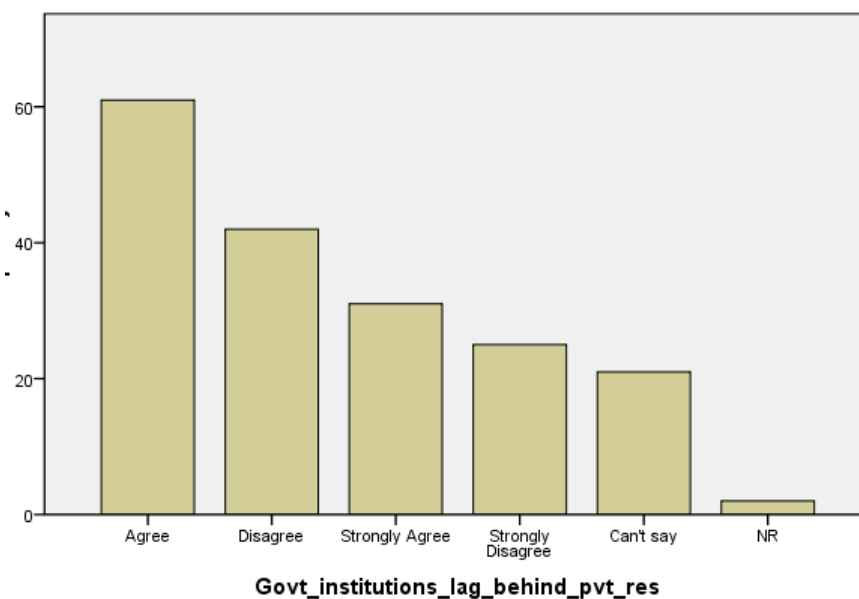


Globalization and the resultant restructuring of the Indian economy influenced state policies on several sectors including agriculture. State funding for crop science research in the country came under critical review assuming that private players of agriculture inputs would take care of the needs of farmers. In an attempt to understand the perceptions of agriculture scientists on the issues of state-funded research and private research a set of questions was asked. Responding to the statement that government institutions are lagging behind private research institutions in agriculture today about 51 percent of the respondents agreed while about 47 percent disagreed (see Table 105).

Table 105: Perceptions of scientists - Government institutions lag behind private research

Government institutions lag behind private research	No. of respondents	Percent
Strongly Agree	31	17.0
Agree	61	33.5
Disagree	42	23.1
Strongly Disagree	25	13.7
Can't say	21	11.5
NR	2	1.1
Total	182	100.0

Fig. 103: Perceptions of scientists - Government institutions lag behind private research



The present study also focussed on to know how crop scientists in the state institutions feel about the problems of farmers in the country, problems of agriculture science research in the country, etc. When the scientists were asked to name the most important problems faced by farmers in the country the responses were wide ranging. List of problems presented in Table 106 shows that majority of the respondents view lack of remunerative price as the most important problem. This is followed by problems related to agricultural markets, availability, quality and cost of agricultural inputs and depleting water resources which were identified as the important problems faced by farmers in the country.

Table 106: Perceptions of scientists - Important problems faced by the farmers

Problems faced by farmers	No. of respondents
Remunerative price for the farmers' product	45
Marketing – access, knowledge, etc.	34
Inputs –availability, cost, quality	29
Water- depletion of ground water, lack of irrigation water, etc.	19
Labour- availability, skill, etc.	16
Climate change issues related to failure of monsoon, irregular rainfall, low rainfall, etc.	14
Cost of cultivation	14
Knowledge- availability and use of technologies	11
Transfer of technologies	5

As regards the important problems faced by agriculture research in the country majority of the respondents identify insufficient funding, disparity and bias in funding as the most important problems. Scarcity of labour in research institutions, lack of focus in research policy are the other important issues plaguing agriculture science research in the country (see Table 107).

Table 107: Perceptions of scientists - Important problems faced by agricultural research in India

Problems faced by agricultural research in the country	No. of respondents
Research funding – insufficient funding, disparity, bias, etc.	82
Labour scarcity in agricultural research institutions	15
Research policy – lack of focus,	12
Bureaucracy	7
Lack of infrastructure	6
Lack of freedom to scientists	5
Need based research	4

Responding to the question on the important contributions of state agricultural research institutions in the last ten years majority of the respondents suggested development of new high yielding, disease resistant, improved varieties of seeds as the most important contribution. This is followed by technology transfer and the contributions in the field of integrated pest management, etc. (see Table 108). Similarly on the important contributions of private agricultural science research in the country majority of the scientists observed that improved, high yielding, pest and disease resistant seed varieties as the most important contribution followed by advancements in molecular biology leading to development of new transgenic variety seed like Bt cotton, and advancements in tissue culture, etc. Besides, respondents also highlighted the development of new pesticide formulations using newer molecules to control pest and diseases (see Table 109).

Table 108: Perceptions of scientists - Five imp contributions from government agricultural research institutions in the last ten years

Five imp contributions from government agricultural research institutions in the last ten years	No. of respondents
New varieties – high yielding, disease resistance, improved, etc.	75
Transfer technology	12
Integrated pest management	9
Increased productivity	2
Seed production	2

Table 109: Perceptions of scientists - Five imp contributions from private agricultural research institutions in the last ten years

Five imp contributions from private agricultural research institutions in the last ten years	No. of respondents
New varieties – Hybrid, high yielding, Pest and Disease resistant, improved, etc.	62
Transgenic varieties including Bt cotton, tissue culture, etc.	25
Introduction of newer molecules which are safer for pest, disease and weed control	16
Extension services	4
Technology development	4
Participatory research	3
Irrigation development	3

### **Agrarian crisis**

Post liberalization agrarian distress is palpable across the country. Suicides by farmers due to distress in Indian agriculture are the most inhuman happenings India could have rarely witnessed. Farmers' suicides reflect the pathological status of agriculture in the country. It is difficult to single out a particular social institution, however, it may be said that different institutions that work to provide equitable space for every individual to live with dignity have failed to perform. In this sense, agricultural research and teaching institutions of the country cannot remain as bystanders. In light of this situation, it was attempted through the survey to understand how the scientific community is viewing the evolving agrarian crisis in the country and where does agricultural science stand in this unfolding scenario.

Intending to know how agricultural scientists look at the problem of farmers' suicides and the reasons for it, a set of statements were drafted against which the respondents were asked to mark their response in the order of agreement on a continuum of one to six, with one being the most agreeable statement and six being the least agreeable statement. Data on the statement 'agricultural science research doesn't address their (farmers') problems' reveal that majority of the respondents are in least agreement (about 58 percent, 5 and 6 together, see Table 110).

Table 111 presents that about 50 percent of the respondents are in agreement (1, 2 and 3 put together) with the statement that government failed to take technologies to farmers while about 42 percent of the respondents are in least agreement (4, 5 and 6 put together). About 50 percent (1, 2 and 3 put together) view that suicides are not related to agricultural problems (see Table 112) while about 50 percent (1, 2 and 3 put together) believe that farmers are not trained to use the agricultural technologies (see Table 113). Responding to the statement that 'other factors like credit and market prices are the reasons for suicide' receives an overwhelming approval (about 86 percent, 1, 2 and 3 together, see Table 114). When asked whether the agricultural scientists had no clue about farmers' suicides majority of the respondents (about 44 percent) were in least agreement with the statement (see Table 115).

Table 110: Reasons for farmers' suicides in the country- Agricultural science research doesn't address the problems of farmers

Agricultural science research don't address the problems of farmers <i>(Ranking in the order of agreement from 1 to 6. 1 being most agreeable and 6 being the least agreeable)</i>	No. of respondents	Percent
1	11	6.1
2	14	7.7
3	11	6.1
4	15	8.3
5	31	17.1
6	74	40.9
NR	25	13.8
Total	181	100.0

Fig. 104: Reasons for farmers' suicides in the country- Agricultural science research doesn't address their problems

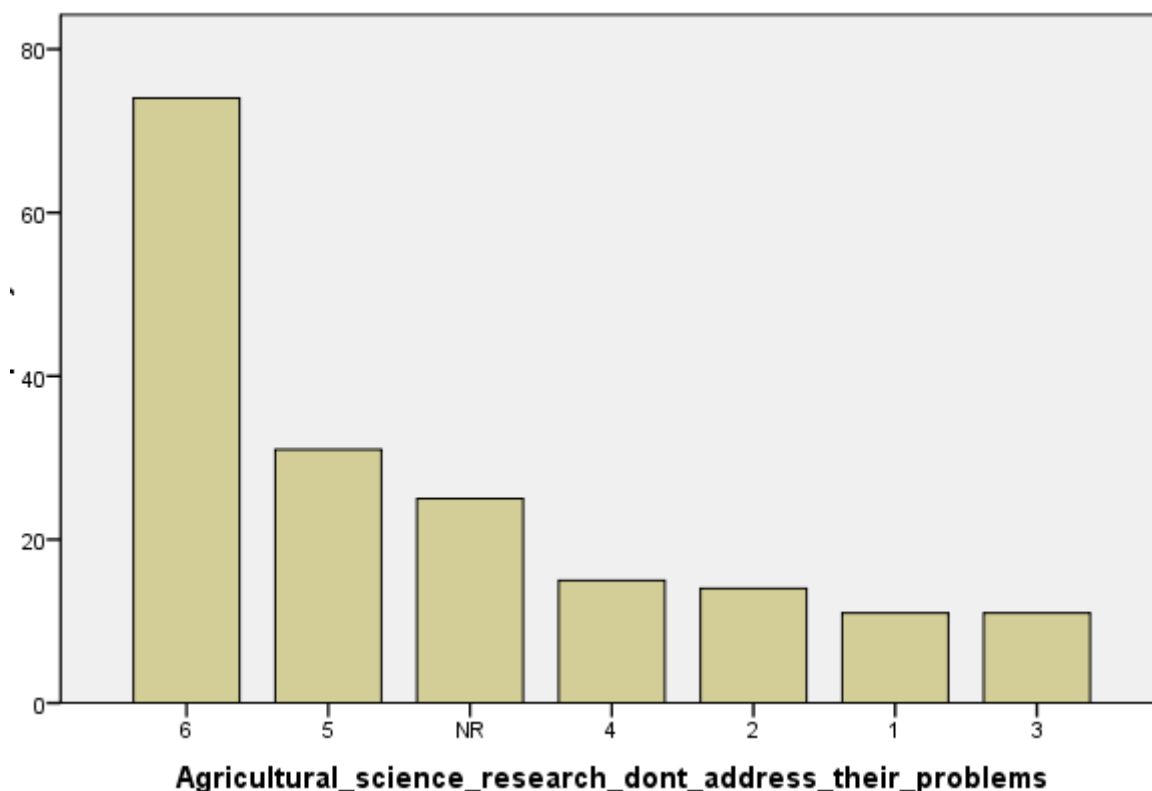


Table 111: Reasons for farmers' suicides in the country- Government failed to take the technologies to the farmers

Government failed to take the technologies to the farmers (Ranking in the order of agreement from 1 to 6. 1 being most agreeable and 6 being the least agreeable)	No. of respondents	Percent
1	22	12.2
2	31	17.1
3	37	20.4
4	30	16.6
5	25	13.8
6	23	12.7
NR	13	7.2
Total	181	100.0

Fig. 105: Reasons for farmers' suicides in the country- Government failed to take the technologies to the farmers

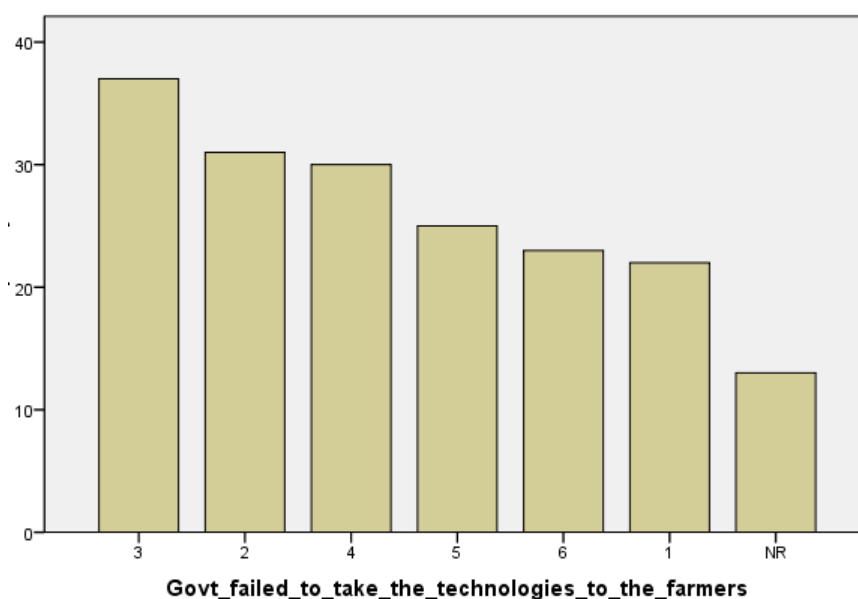


Table 112: Reasons for farmers' suicides in the country- Suicides are not related to agricultural problems

Suicides are not related to agricultural problems (Ranking in the order of agreement from 1 to 6. 1 being most agreeable and 6 being the least agreeable)	No. of respondents	Percent
1	29	16.0
2	35	19.3
3	27	14.9
4	15	8.3
5	30	16.6
6	37	20.4
NR	8	4.4
Total	181	100.0

Fig. 106: Reasons for farmers' suicides in the country- Suicides are not related to agricultural problems

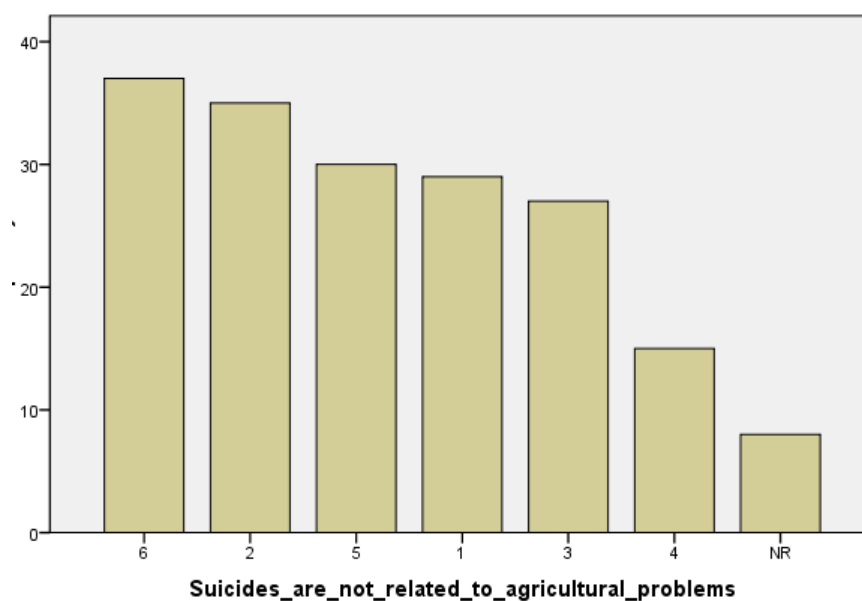


Table 113: Reasons for farmers' suicides in the country- Farmers are not trained to use the agricultural technologies

Farmers are not trained to use the agricultural technologies (Ranking in the order of agreement from 1 to 6. 1 being most agreeable and 6 being the least agreeable)	No. of respondents	Percent
1	13	7.2
2	35	19.3
3	43	23.8
4	29	16.0
5	19	10.5
6	29	16.0
NR	13	7.2
Total	181	100.0

Fig. 107: Reasons for farmers' suicides in the country- Farmers are not trained to use the agricultural technologies

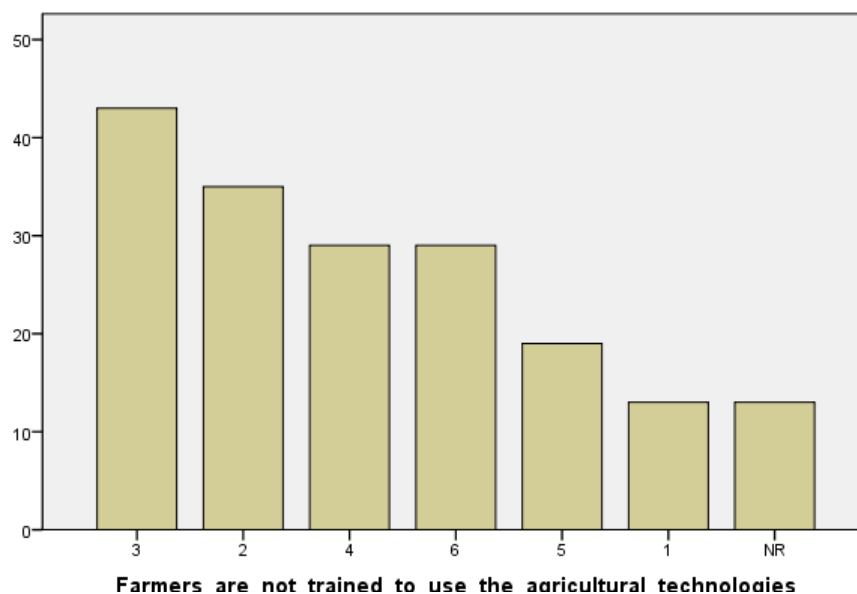


Table 114: Reasons for farmers' suicides in the country- Other factors like credit and market prices are the reasons

Other factors like credit and market prices are the reasons (Ranking in the order of agreement from 1 to 6. 1 being most agreeable and 6 being the least agreeable)	No. of respondents	Percent
1	98	54.1
2	43	23.8
3	15	8.3
4	6	3.3
5	9	5.0
6	4	2.2
NR	6	3.3
Total	181	100.0

Fig 108: Reasons for farmers' suicides in the country- Other factors like credit and market prices are the reasons

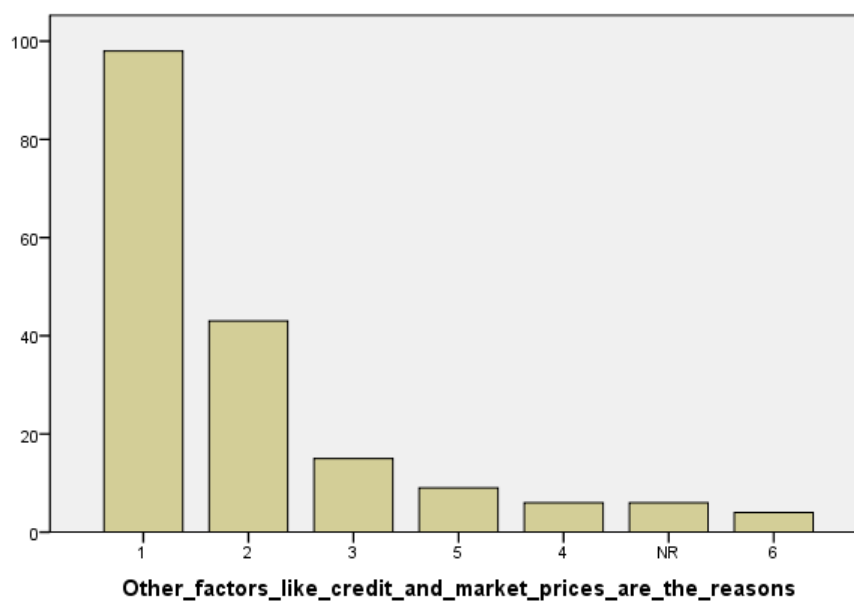
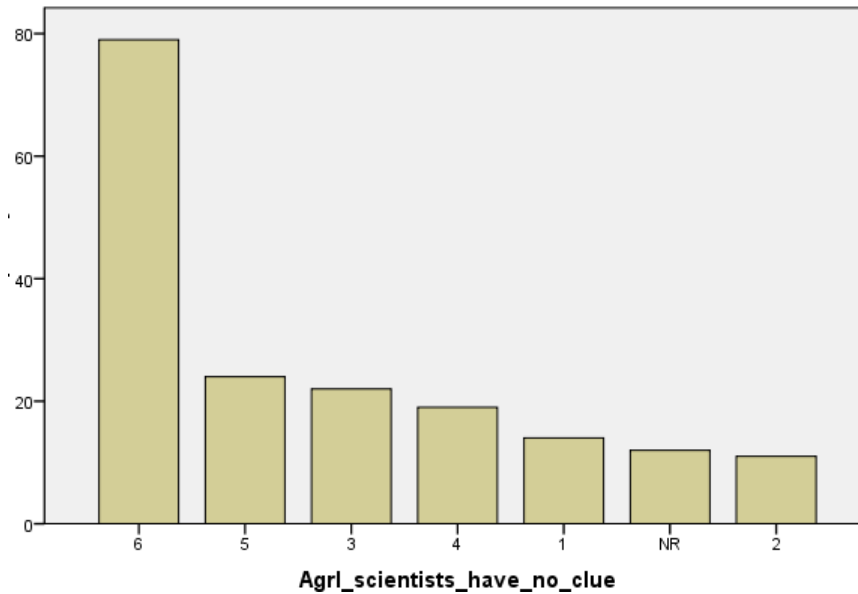


Table 115: Reasons for farmers' suicides in the country- Agricultural scientists have no clue about farmers' suicides

Agricultural scientists have no clue about farmers' suicides (Ranking in the order of agreement from 1 to 6. 1 being most agreeable and 6 being the least agreeable)	No. of respondents	Percent
1	14	7.7
2	11	6.1
3	22	12.2
4	19	10.5
5	24	13.3
6	79	43.6
NR	12	6.6
Total	181	100.0

Fig. 109: Reasons for farmers' suicides in the country- Agricultural scientists have no clue



Acknowledging the fact that the green revolution benefitted nation enormously the present study attempted to know the perceptions of scientists on the different aspects of the benefits of the green revolution. A set of statements related to the perceived benefits of green revolution was given to the scientists for rating in the order of benefits from one to four, one being the most agreeable and four being the least agreeable. Responding to the statement that the green revolution increased yields a large majority of the respondents (about 82 percent) considered it as the most agreeable contribution (see table 116). The second statement that 'green revolution added to the problems of the environment' attracted less agreeable response from a majority of the respondents (about 56 percent) while about 41 percent considered it as an agreeable option (see Table 117). This implies that a considerable section of scientists locates the issues of the environment in the green revolution. Out of 184 respondents about 78 percent were in agreement with the statement that green revolution benefitted farmers in the country (see Table 118). Similarly a majority of the respondents (about 75 percent) were also in agreement with the statement that green revolution benefitted the nation (see Table 119).

Table 116: Green revolution in the country- Increased yields

Increased yields <i>(Ranking in the order of agreement with the given technologies from 1 to 4. 1 being most agreeable and 4 being the least agreeable)</i>	No. of respondents	Percent
1	150	81.5
2	20	10.9
3	6	3.2
4	6	3.3
NR	2	1.1
Total	184	100.0

Fig. 110: Green revolution in the country- Increased yields

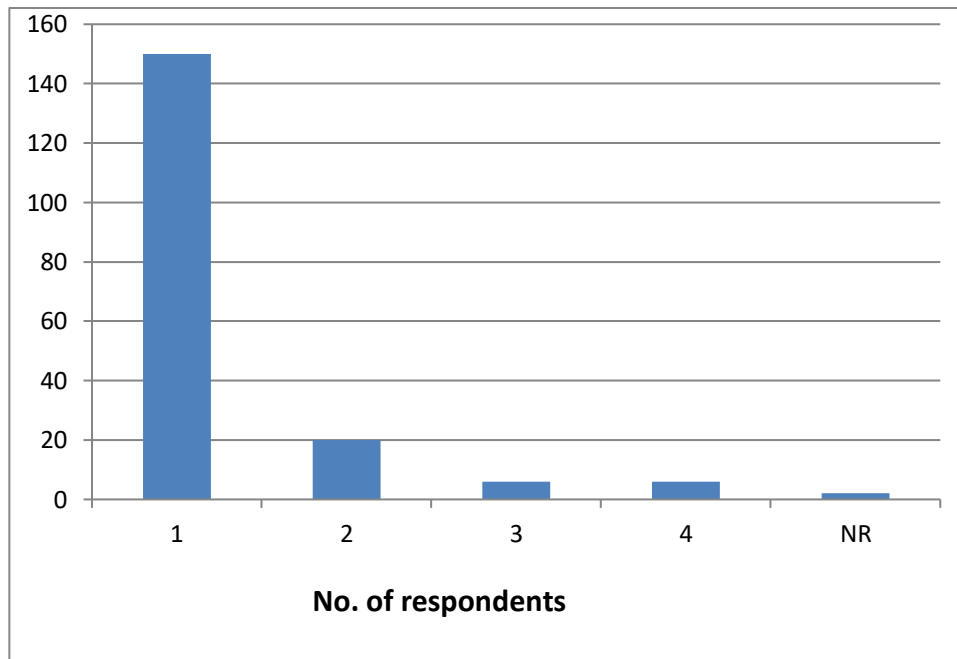


Table 117: Green revolution in the country- Added to the problems of the environment

Added to the problems of the environment (Ranking in the order of agreement with the given technologies from 1 to 4. 1 being most agreeable and 4 being the least agreeable)	No. of respondents	Percent
1	35	19.0
2	41	22.3
3	50	27.2
4	52	28.3
NR	6	3.3
Total	184	100.0

Fig. 111: Green revolution in the country- Added to the problems of the environment

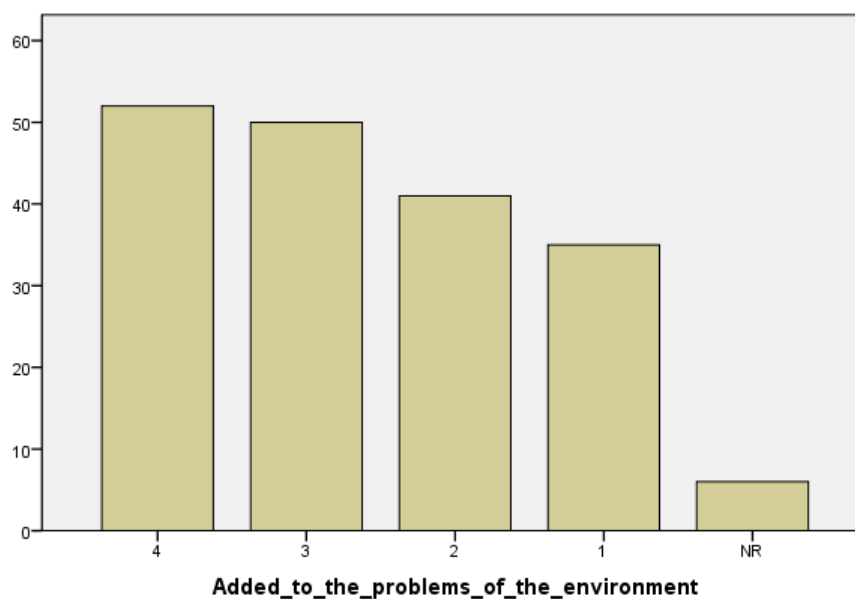


Table 118: Green revolution in the country- Benefited farmers

Benefited farmers (Ranking in the order of agreement with the given technologies from 1 to 4. 1 being most agreeable and 4 being the least agreeable)	No. of respondents	Percent
1	73	39.7
2	70	38.0
3	25	13.6
4	5	2.7
NR	11	6.0
Total	184	100.0

Fig. 112: Green revolution in the country- Benefited farmers

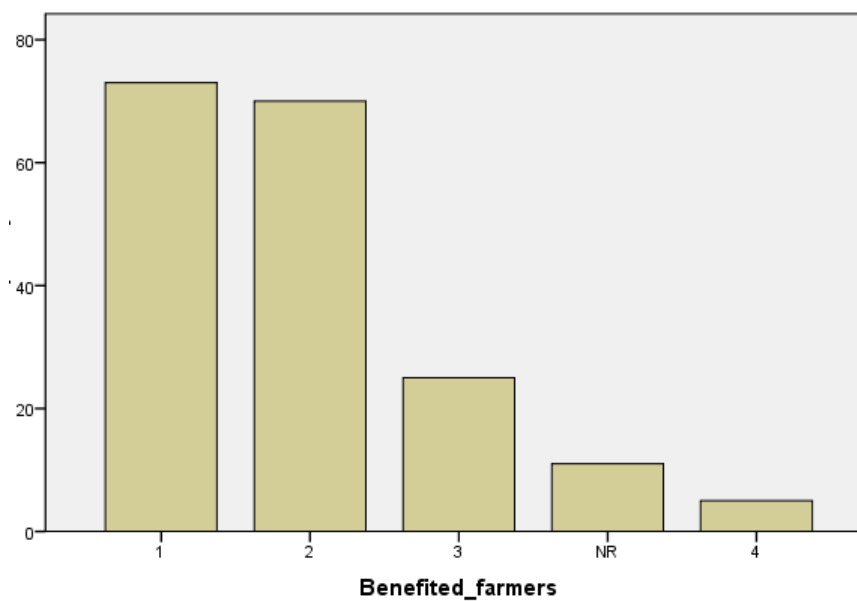
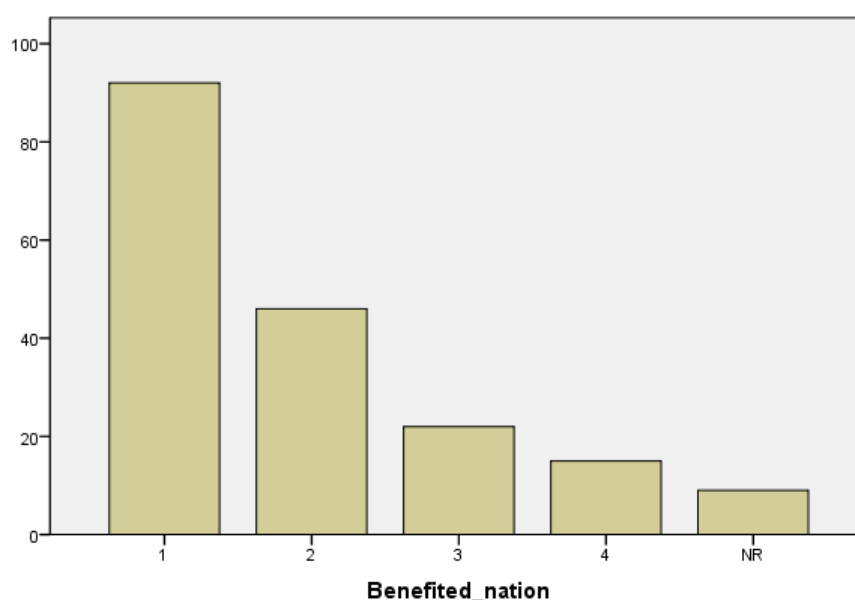


Table 119: Green revolution in the country- Benefited nation

Benefited nation <i>(Ranking in the order of agreement with the given technologies from 1 to 4. 1 being most agreeable and 4 being the least agreeable)</i>	No. of respondents	Percent
1	92	50.0
2	46	25.0
3	22	12.0
4	15	8.2
NR	9	4.9
Total	184	100.0

Fig. 113: Green revolution in the country- Benefited nation



One of the important problems of agriculture in the country is the wide gap between the recommended field practices (called as best management practices) by the scientists and the actual practices of farmers. With an aim to know how the scientists look at the gap between the two kinds of practices, a set of statements related to different cultivation practices was given. Majority of the respondents (see Table 120) observed that farmers do not follow the recommended seed rate. About 82 percent of the respondents observed that farmers don't follow appropriate fertilizer dosage (see Table 121), while 80 percent respondents were of the opinion that farmers don't follow the recommended dosage of pesticide (see Table 122). Similarly, data suggest that about 67 percent consider

that farmers don't follow weedicide dosage appropriately (see Table 123). On the practice of intercultivation, weeding, use of machinery and harvesting practices a majority of the respondents believe that farmers don't follow the recommended practices appropriately (see Tables 124 to 128).

Table 120: Farmers follow the recommended practices – Seed rate

Seed rate	No. of respondents	Percent
Do not Follow Appropriately	94	51.6
Follow Appropriately	85	46.7
Don't know	2	1.1
NR	1	.5
Total	182	100.0

Fig. 114: Farmers follow the recommended practices – Seed rate

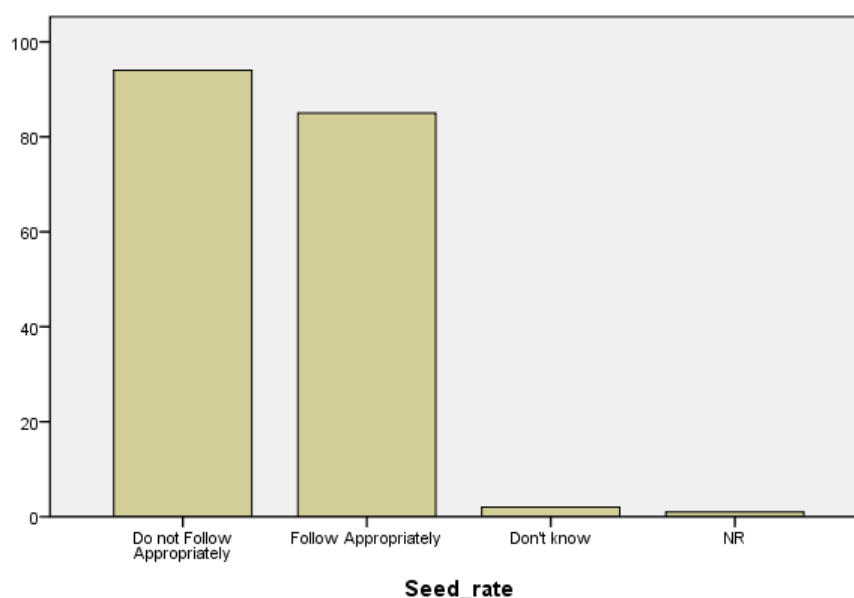


Table 121: Farmers follow the recommended practices – Fertilizer dosage

Fertilizer dosage	No. of respondents	Percent
Do not Follow Appropriately	149	81.9
Follow Appropriately	31	17.0
Don't know	2	1.1
Total	182	100.0

Fig.115: Farmers follow the recommended practices – Fertilizer dosage

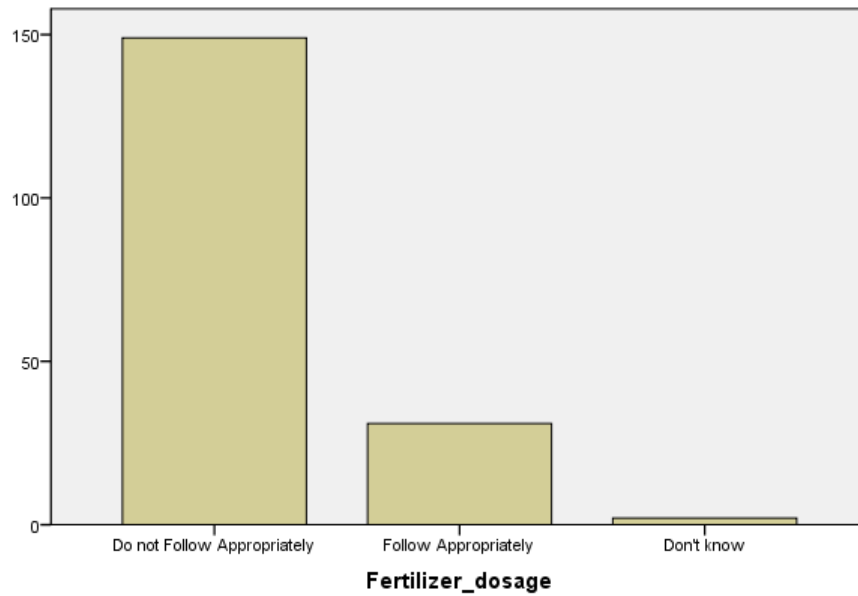


Table 122: Farmers follow the recommended practices – Pesticide dosage

Pesticides dosage	No. of respondents	Percent
Do not Follow Appropriately	145	79.7
Follow Appropriately	26	14.3
Don't know	10	5.5
NR	1	.5
Total	182	100.0

Fig. 116: Farmers follow the recommended practices – Pesticide dosage

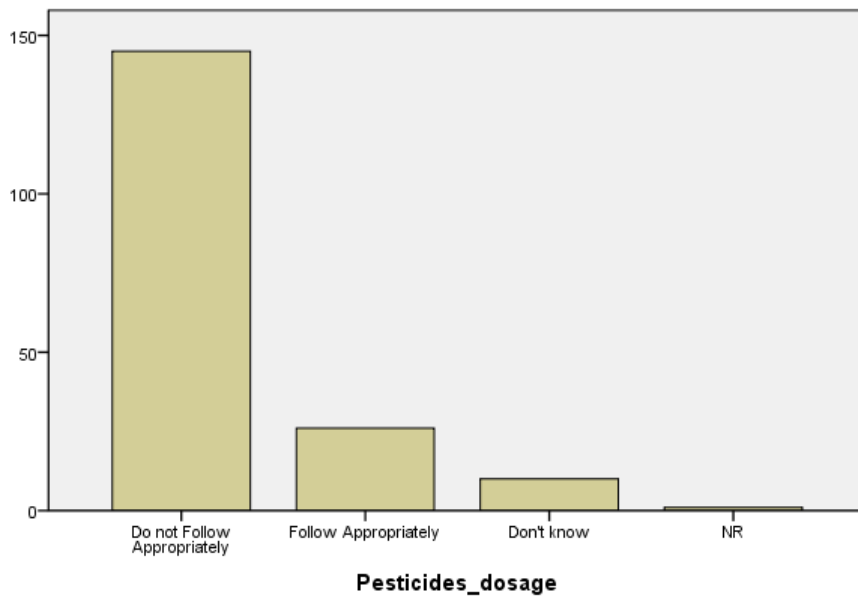


Table 123: Farmers follow the recommended practices – Weedicides dosage

Weedicides dosage	No. of respondents	Percent
Do not Follow Appropriately	121	66.5
Follow Appropriately	43	23.6
Don't know	17	9.3
NR	1	.5
Total	182	100.0

Fig. 117: Farmers follow the recommended practices – Weedicides dosage

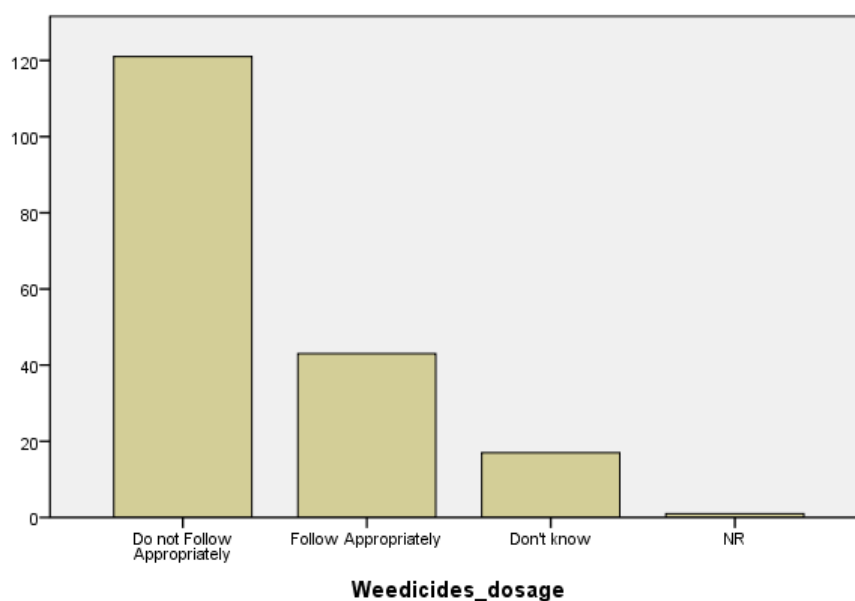


Table 124: Farmers follow the recommended practices – Intercultivation practices

Intercultivation practices	No. of respondents	Percent
Do not Follow Appropriately	96	52.7
Follow Appropriately	76	41.8
Don't know	9	4.9
NR	1	.5
Total	182	100.0

Fig. 118: Farmers follow the recommended practices – Intercultivation practices

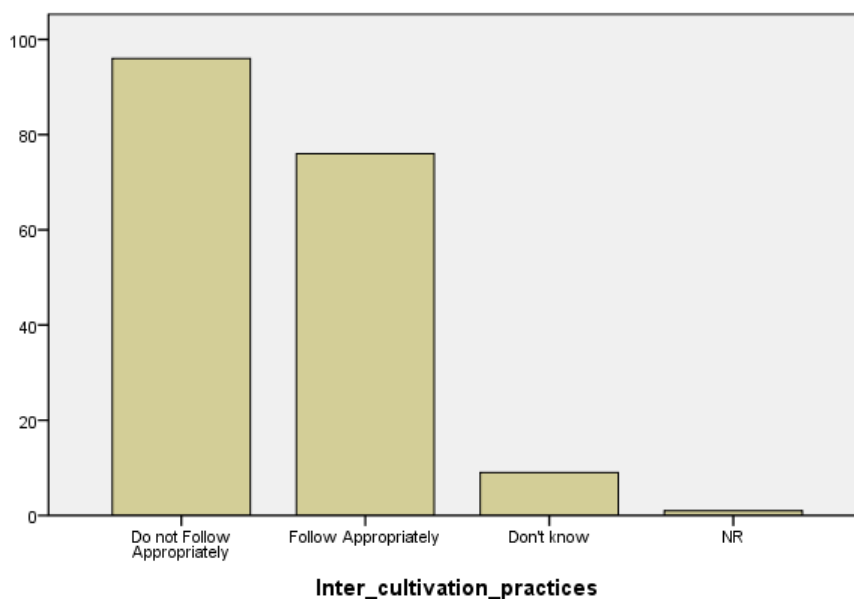


Table 125: Farmers follow the recommended practices – Weeding operations

Weeding operations	No. of respondents	Percent
Do not Follow Appropriately	94	51.6
Follow Appropriately	70	38.5
Don't know	15	8.2
NR	3	1.6
Total	182	100.0

Fig. 119: Farmers follow the recommended practices – Weeding operations

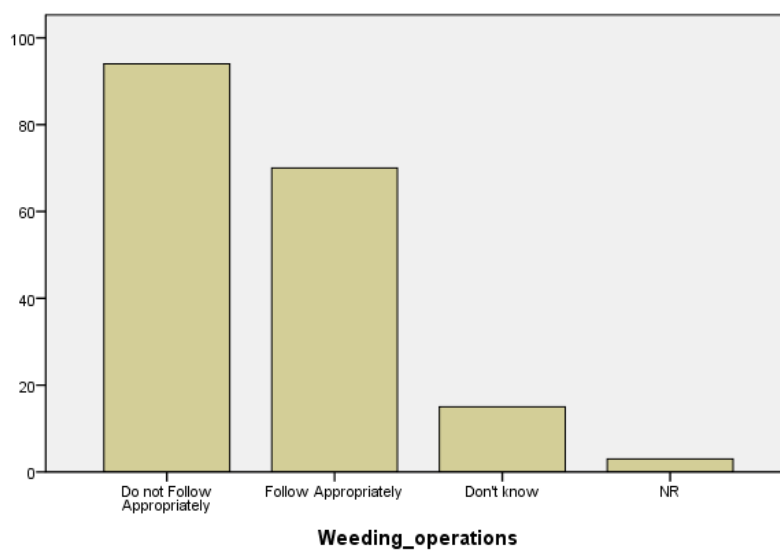


Table 126: Farmers follow the recommended practices –Land preparation operations

Land preparation operations	No. of respondents	Percent
Follow Appropriately	100	54.9
Do not Follow Appropriately	71	39.0
Don't know	6	3.3
NR	5	2.7
Total	182	100.0

Fig. 120: Farmers follow the recommended practices –Land preparation operations

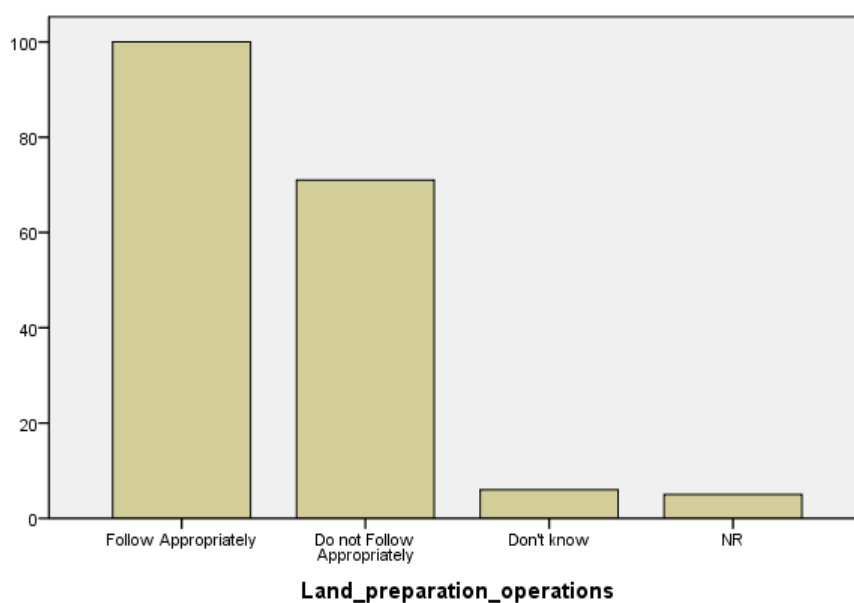


Table 127: Farmers follow the recommended practices –Use of machinery tools

Use of machinery tools	No. of respondents	Percent
Do not Follow Appropriately	104	57.1
Follow Appropriately	62	34.1
Don't know	11	6.0
NR	5	2.7
Total	182	100.0

Fig. 121: Farmers follow the recommended practices –Use of machinery tools

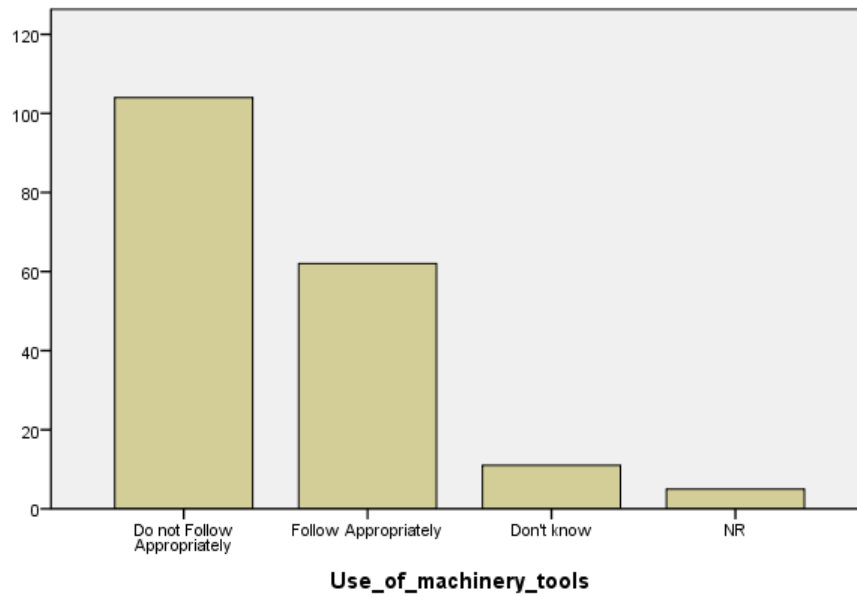
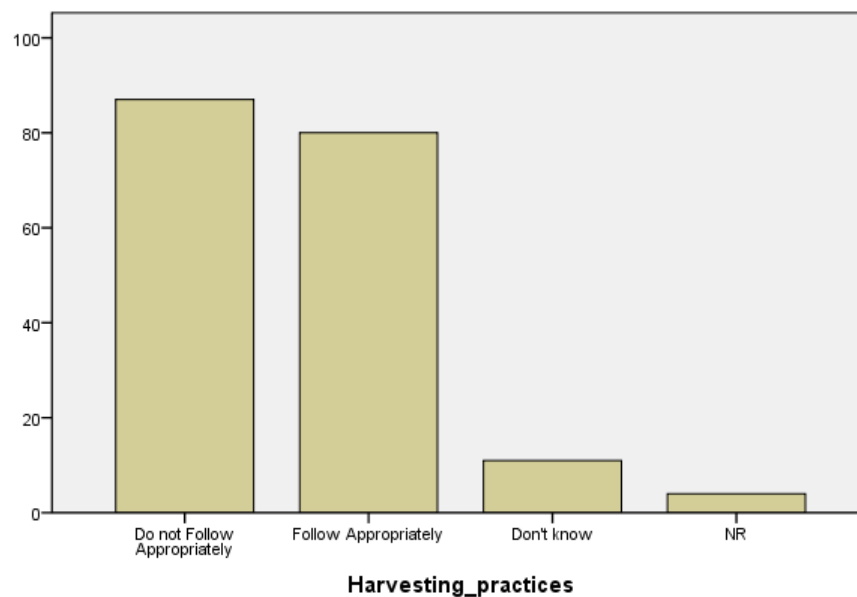


Table 128: Farmers follow the recommended practices –Harvesting practices

Harvesting practices	No. of respondents	Percent
Do not Follow Appropriately	87	47.8
Follow Appropriately	80	44.0
Don't know	11	6.0
NR	4	2.2
Total	182	100.0

Fig. 122: Farmers follow the recommended practices –Harvesting practices

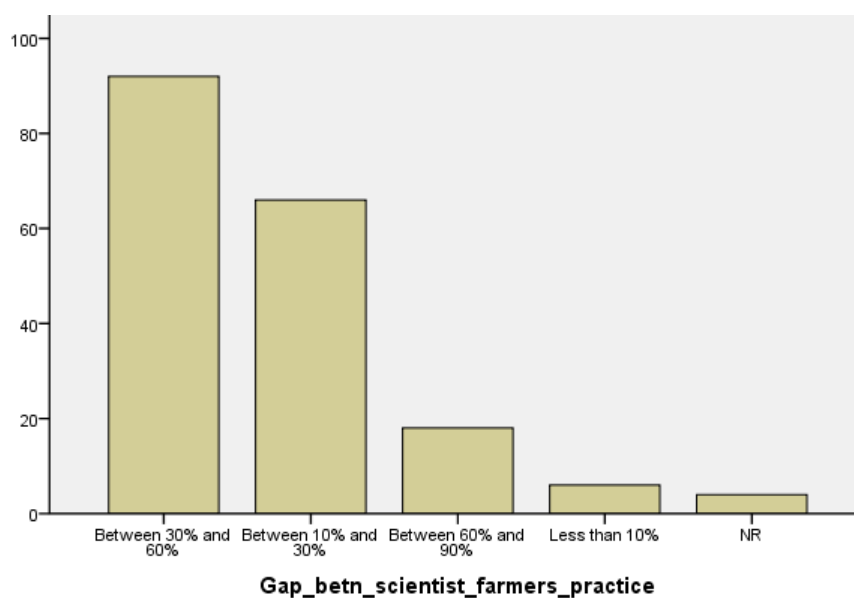


In an attempt to know the perception of scientists on the magnitude of the gap between recommended practices and farmers' practices the scientists were asked to rate the extent of gap, to which majority of the respondents, i.e. about 50 percent observed that the gap is between 30 to 60 percent.

Table 129: Extent of gap between scientist's and farmers' practices

Gap between scientist's and farmers' practices	No. of respondents	Percent
Between 30% and 60%	92	49.5
Between 10% and 30%	66	35.5
Between 60% and 90%	18	9.7
Less than 10%	6	3.2
NR	4	2.2
Total	186	100.0

Fig. 123: Extent of gap between scientist's and farmers' practices



Those who demand critical examination of the present agricultural research paradigm that is dominated by positivist methods and approach also call for participatory research involving farmers at every stage of research. The research agendas which are oriented to address the problems of not just productivity and efficiency but also relevant at the small and marginal farmers' context are being demanded by the civil society organizations, social scientists and environmentalists.

In this context scientists' perception on farmers' knowledge, and yield as a parameter to evaluate success or relevance for farmers was assessed. Majority of the respondents (about 63 percent) observed that farmers' traditional knowledge is relevant to a limited extent in overcoming the problems of agriculture today (see Table 130). About 44 percent of the respondents believe that farmers' traditional knowledge is relevant to a limited extent in overcoming the problems of environment today while about 43 percent believe it to be relevant to a great extent (see Table 131). As far as increasing yields is concerned about 50 percent of the respondents believe that farmers' traditional knowledge is relevant to a limited extent only while about 22 percent believe it to be not relevant (see Table 132). However, when looked at the issue of cultivation from small and marginal farmers' point of view majority of the respondents (about 66 percent) believe that farmers' traditional knowledge is relevant to a great extent at the small and marginal farmers level (see Table 133). On the issue of relevance of farmers' traditional knowledge at socially backward farmers' level about 41 percent of the respondents believe it to be relevant to a limited extent while 18 percent believe it to be relevant to a great extent (see Table 134).

Table 130: Farmers' traditional knowledge is relevant in overcoming the problems of agriculture today

Problems of agriculture today	No. of respondents	Percent
Relevant to a limited extent	118	63.4
Relevant to a great extent	50	26.9
Not Relevant	8	4.3
Don't know	5	2.7
NR	5	2.7
Total	186	100.0

Fig 124: Farmers' traditional knowledge is relevant in overcoming the problems of agriculture today

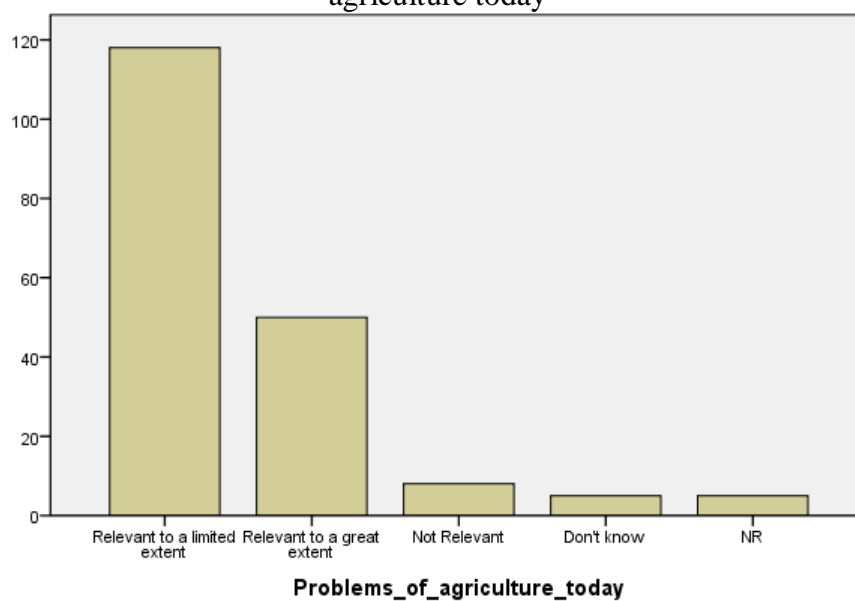


Table 131: Farmers' traditional knowledge is relevant in overcoming the problems of environment today

Problems of environment today	No. of respondents	Percent
Relevant to a limited extent	81	43.5
Relevant to a great extent	80	43.0
Not Relevant	11	5.9
Don't know	8	4.3
NR	6	3.2
Total	186	100.0

Fig. 125: Farmers' traditional knowledge is relevant in overcoming the problems of environment today

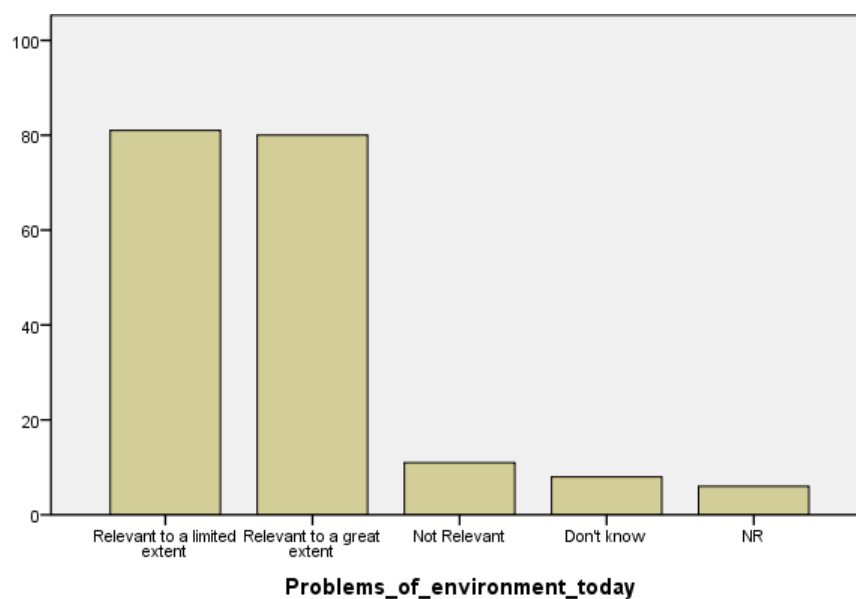


Table 132: Farmers' traditional knowledge is relevant in increasing yields

In increasing yields	No. of respondents	Percent
Relevant to a limited extent	93	50.0
Not Relevant	41	22.0
Relevant to a great extent	36	19.4
Don't know	12	6.5
NR	4	2.2
Total	186	100.0

Fig. 126: Farmers' traditional knowledge is relevant in increasing yields

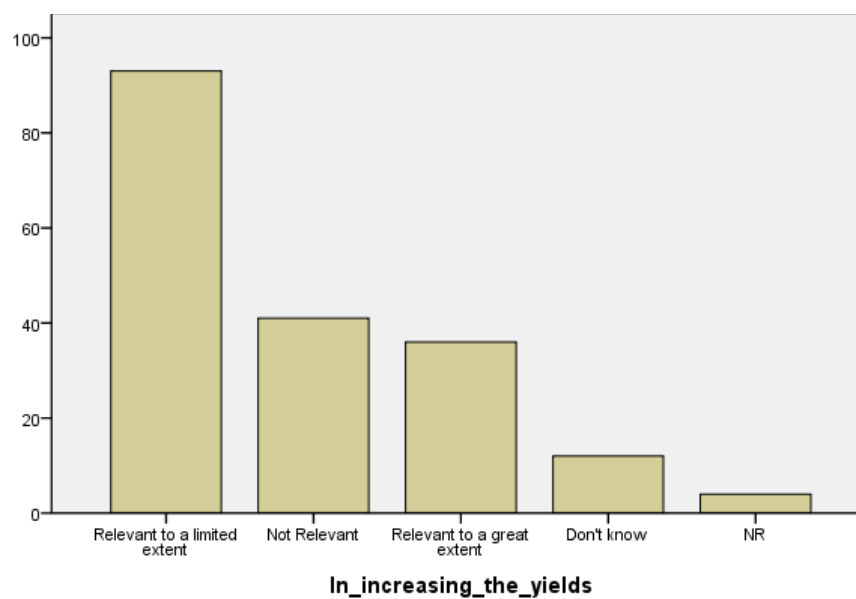


Table 133: Farmers' traditional knowledge is relevant at small and marginal farmers' level

At small and marginal farmers level	No. of respondents	Percent
Relevant to a great extent	122	65.6
Don't know	23	12.4
Relevant to a great extent	23	12.4
Not Relevant	14	7.5
NR	4	2.2
Total	186	100.0

Fig. 127: Farmers' traditional knowledge is relevant at small and marginal farmers' level

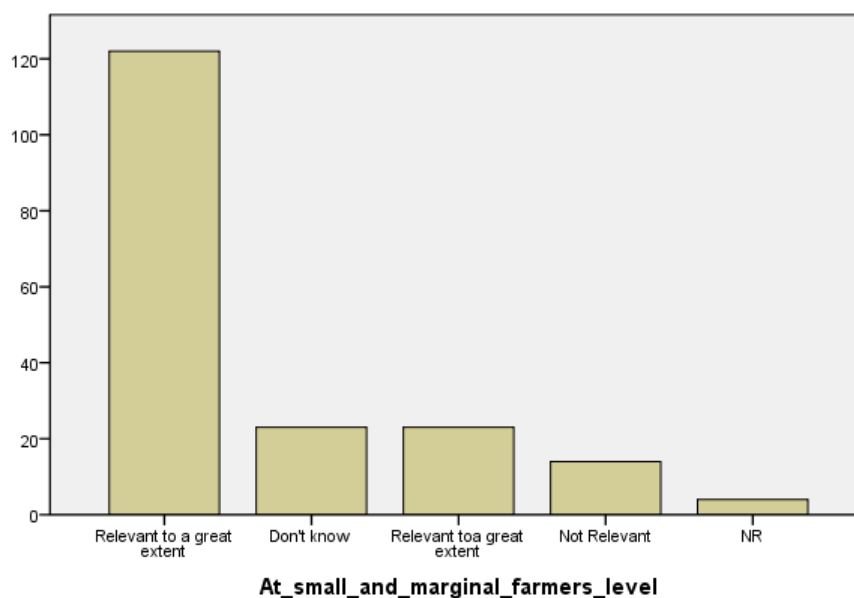
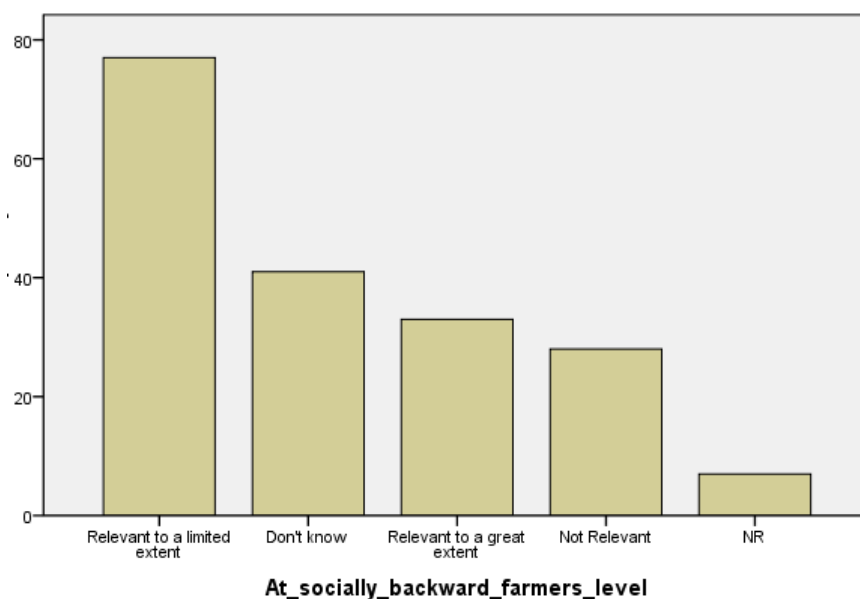


Table 134: Farmers' traditional knowledge is relevant at socially backward farmers' level

At socially backward farmers level	No. of respondents	Percent
Relevant to a limited extent	77	41.4
Don't know	41	22.0
Relevant to a great extent	33	17.7
Not Relevant	28	15.1
NR	7	3.8
Total	186	100.0

Fig. 128: Farmers’ traditional knowledge is relevant at socially backward farmers’ level

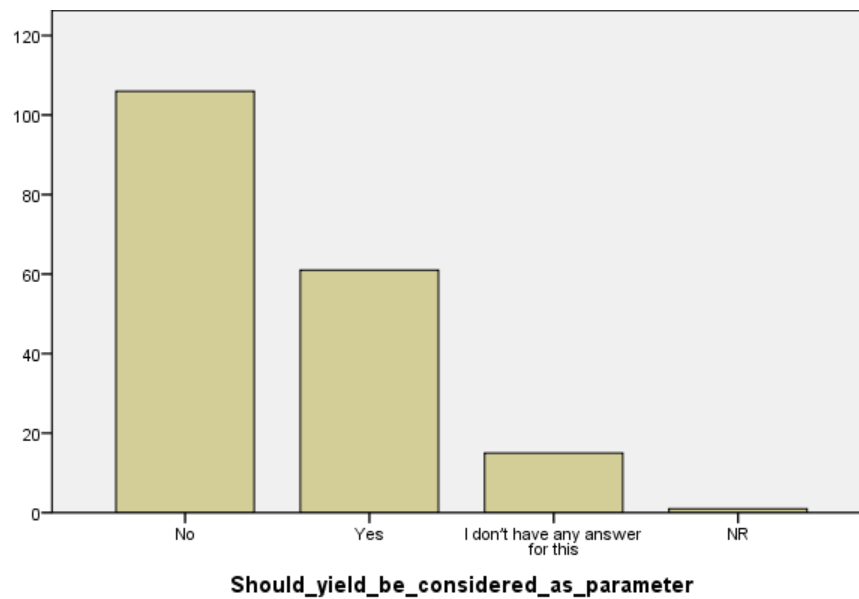


At the same time a majority of the respondents (about 58 percent) observe that yield alone should not be considered as a parameter for recommendation to farmers while about 33 percent believe so.

Table 135: Should yield be considered as the only parameter as recommendation to farmers

Should yield be considered as parameter	No. of respondents	Percent
No	106	57.9
Yes	61	33.3
I don't have any answer for this	15	8.2
NR	1	.5
Total	183	100.0

Fig. 129: Should yield be considered as the only parameter as recommendation to farmers



In line with the preceding discussion on positivist paradigm of the green revolution, a set of statements were given to record the opinion of scientists on the benefits of the green revolution. Responses were measured on a continuum of 1 to 4 where 1 stands for most agreeable and 4 for least agreeable. Out of 94 respondents about 53 percent agree with the statement that increasing the yields is the primary concern of agriculture (see Table 136). Responding to the statement that increasing yields is necessary from the point of view of the nation’s food security about 47 percent found it to be the most agreeable option (see Table 137). About 45 percent found the statement that increasing yields is necessary for farmers to gain from agriculture as the most agreeable statement (see Table 138). Interestingly the response of the scientists to the statement that ‘increasing yields is what primarily accounts for our research’ received responses which are more or less evenly placed on the spectrum of most agreeable to the least agreeable (see Table 139).

Table 136: Response on yield be considered as the only parameter as recommendation to farmers

Yes, increasing the yields is the primary concern of agriculture	No. of respondents	Percent
1	50	53.2
2	22	23.4
3	16	17.0
4	2	2.1
NR	4	4.3
Total	94	100.0

Fig. 130: Response on yield be considered – primary concern of agriculture

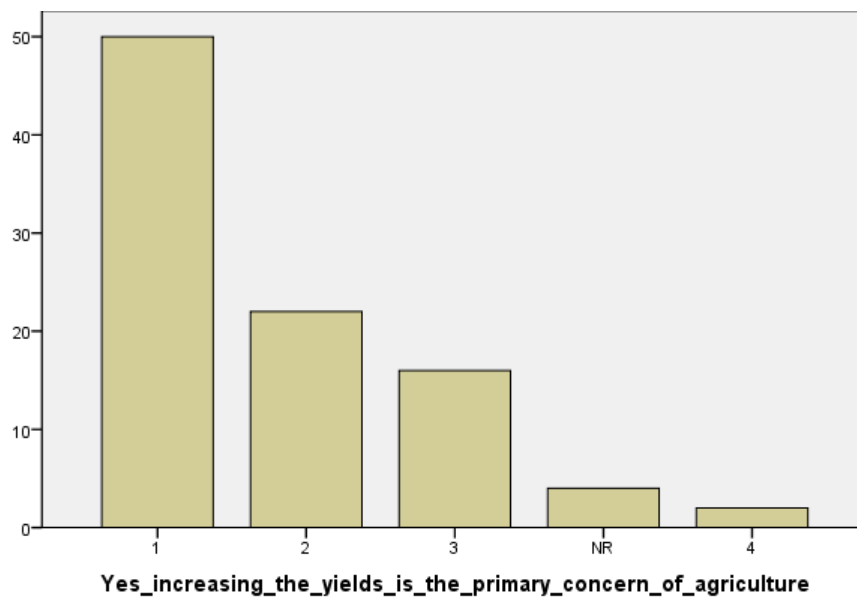


Table 137: Response on yield be considered – increasing yields is necessary

Yes increasing yields is necessary from the point of view of nation's food security	No. of respondents	Percent
1	44	46.8
2	33	35.1
3	10	10.6
4	2	2.1
NR	5	5.3
Total	94	100.0

Fig. 131: Response on yield be considered – increasing yields is necessary

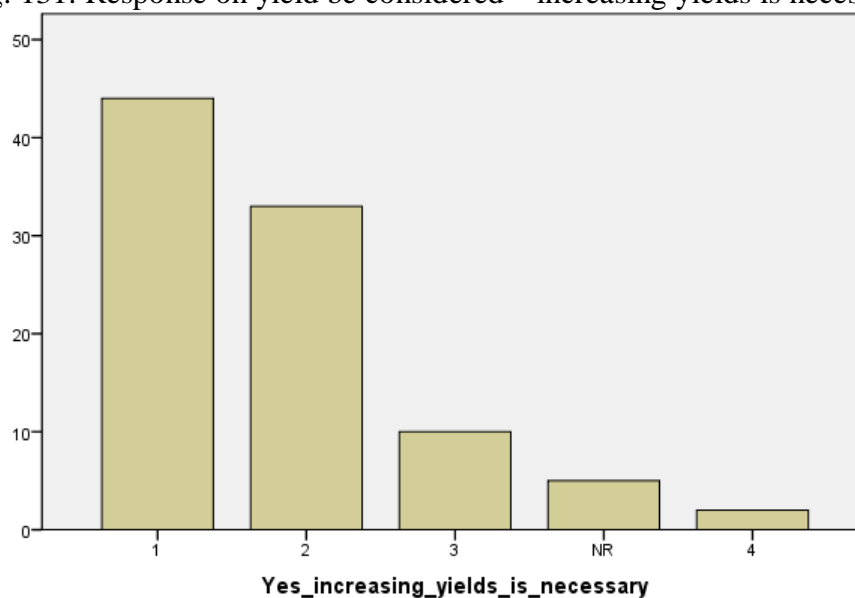


Table 138: Response on yield be considered – increasing yields is necessary for farmers to gain from agriculture

Yes increasing yields is necessary for farmers to gain from agriculture	No. of respondents	Percent
1	42	44.7
2	33	35.1
3	15	16.0
NR	4	4.3
Total	94	100.0

Fig. 132: Response on yield be considered – increasing yields is necessary for farmers to gain from agriculture

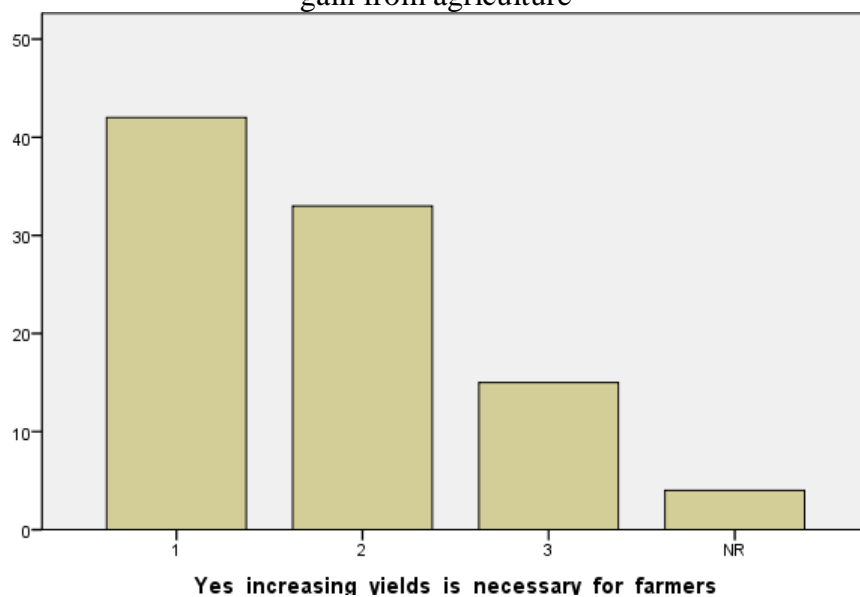
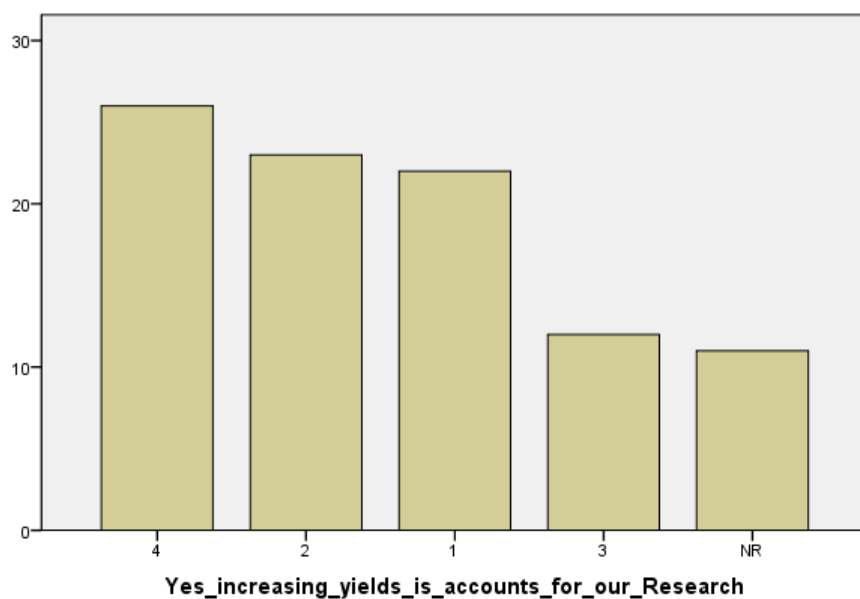


Table 139: Response on yield be considered –primarily accounts for research

Yes increasing yields is accounts for our research	No. of respondents	Percent
1	22	23.4
2	23	24.5
3	12	12.8
4	26	27.7
NR	11	11.7
Total	94	100.0

Fig. 133: Response on yield be considered –primarily accounts for research

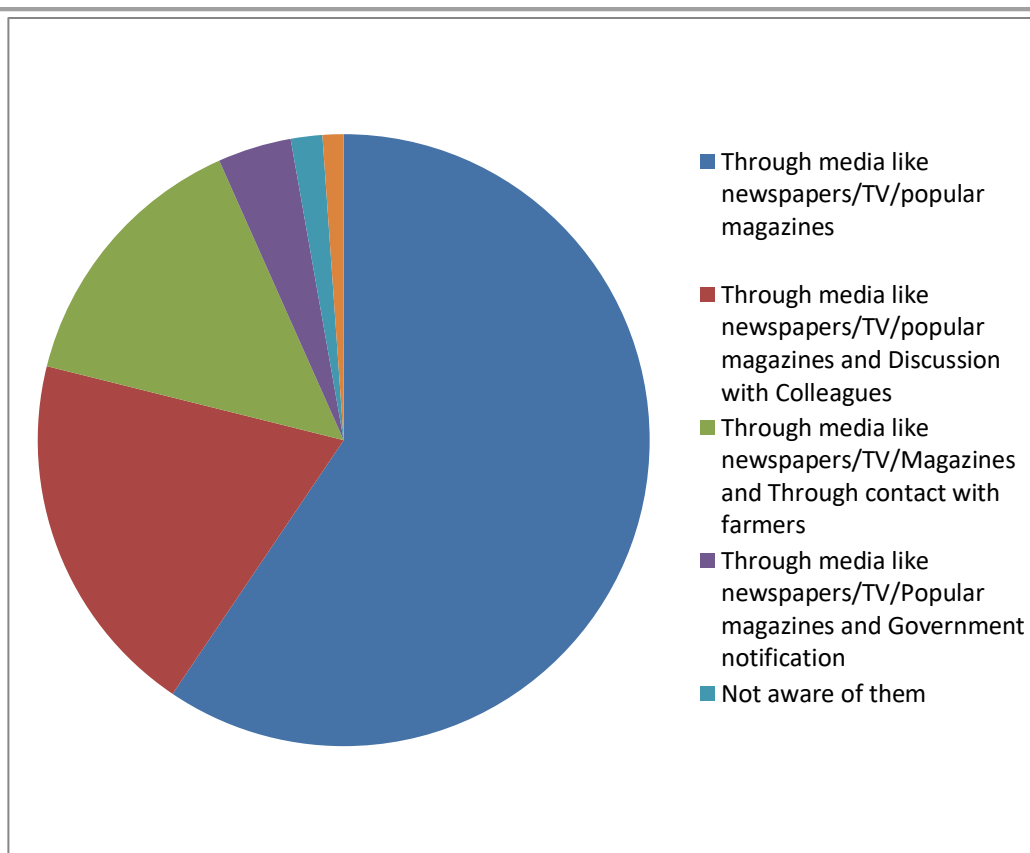


On the issue of farmers' suicides a question was asked as to how the agricultural scientists come to know about it. Responding to this about 59 percent mentioned that they came to know through mass media like news papers, Television and popular magazines.

Table 140: Sources of awareness on farmers' suicides

Sources of awareness	No. of respondents	Percent
Through media like newspapers/TV/popular magazines	107	59.4
Through media like newspapers/TV/popular magazines and Discussion with Colleagues	35	19.4
Through media like newspapers/TV/Magazines and Through contact with farmers	26	14.4
Through media like newspapers/TV/Popular magazines and Government notification	7	3.9
Not aware of them	3	1.7
Through contact with farmers	2	1.1
Total	180	100.0

Fig. 134: Sources of awareness on farmers' suicides



### Priorities of crop science research in the country

The given below list presents the perception of scientists on the priorities of agriculture science research projects in the last ten years. The responses are listed under very high priority, high priority, low priority and very low priority. Biotechnology and climate change related topics emerged as very high priority areas while seed production, traditional knowledge related research projects received very low priority.

Very high priority	High priority	Low Priority	Very low priority
Biotechnology- Stress/Resistance breeding	Molecular breeding	Basic research	Seed production
Yield/productivity enhancing	Variety development	Dissemination of technology	Traditional knowledge
Climate change mitigation/Climate resilient agriculture	Yield/Productivity enhancement	Agronomy and field crops	Basic research
Rural Development	Women Development	Varietal development	Dissemination of technology
Reducing yield gaps	Farmer suicides		Agronomy and field crops
Post harvest	Climate change/ Climate resilient agriculture		Varietal development
Natural resource management	Improving farmers' income		
Organic agriculture	IPM		
National food security	Mechanization		
IPM and Eco friendly pest management measures			
Diffusion and adoption / Transfer of technology			
Farm mechanization			
Crop insurance			
Draught tolerance			
Farmers need based research project			
Market assisted selection (MAS)			
Sustainable agriculture			
Water management			

### Agriculture scientists and farmers

Responding to the statement that farmers have stopped relying on agricultural scientists for suggestions about 51 percent of the respondents disagreed while about 25

percent strongly disagreed (see Table 141). About 58 percent of the respondents disagreed with the statement that ‘farmers are in need of information but scientists are not accessible’ while 32 percent agreed (see Table 142). The state agriculture department is entrusted with the responsibility of providing extension services. Responding to the statement that ‘farmers’ needs are met by the agriculture department’ about 70 percent agreed (see Table 143). Responding to the statement that ‘farmers’ needs are met by the private market sources’ about 50 percent of the respondents disagreed (see Table 144).

Table 141: Farmers’ perception on agricultural scientists - Farmers have stopped relying on agricultural scientists for suggestions

Farmers have stopped relying on agricultural scientists for suggestions	No. of respondents	Percent
Strongly Agree	10	5.4
Agree	17	9.2
Strongly Disagree	45	24.5
Disagree	93	50.5
Don't know	15	8.2
NR	3	1.6
Can't say	1	.5
Total	184	100.0

Fig. 135: Farmers’ perception on agricultural scientists - Farmers have stopped relying on agricultural scientists for suggestions

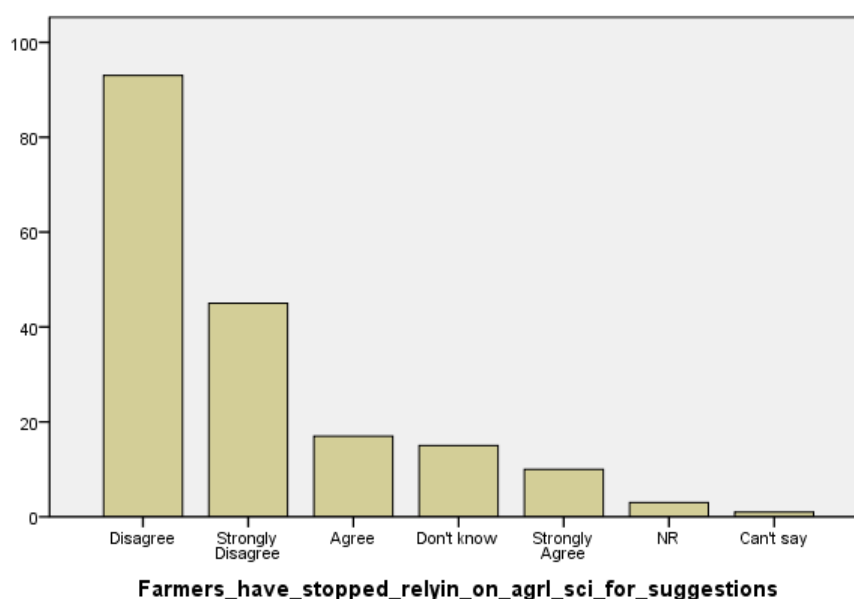


Table 142: Farmers' perception on agricultural scientists - Farmers are in need of information but scientists not accessible

Farmers are in need of information but scientists not accessible	No. of respondents	Percent
Strongly Agree	10	5.4
Agree	49	26.6
Disagree	82	44.6
Strongly Disagree	24	13.0
Don't know	10	5.4
Can't say	4	2.2
NR	3	1.6
Strongly agree	2	1.1
Total	184	100.0

Fig. 136: Farmers' perception on agricultural scientists - Farmers are in need of information but scientists are not accessible

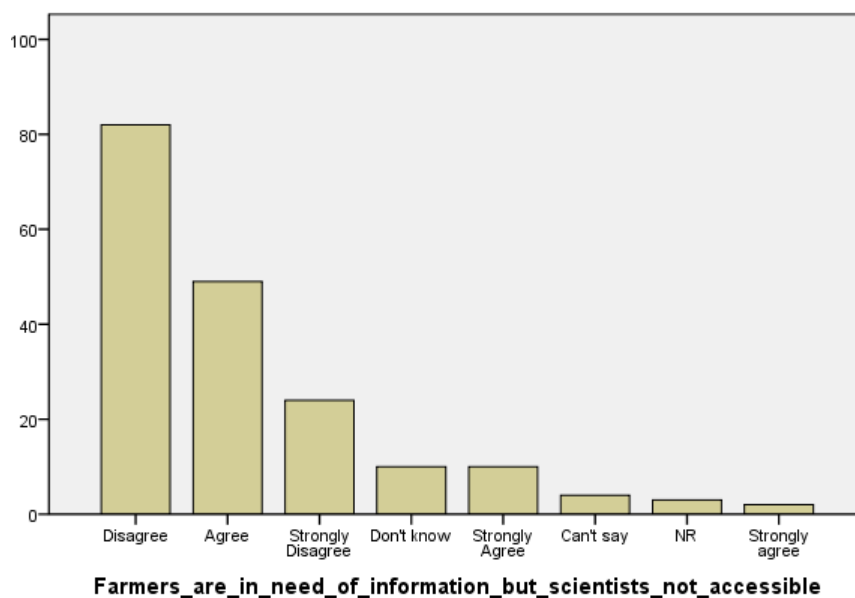


Table 143: Farmers’ perception on agricultural scientists – Farmers’ needs are met by the agriculture department

Farmers’ needs are met by the agriculture department	No. of respondents	Percent
Strongly Agree	28	15
Agree	101	55
Disagree	28	15
Strongly Disagree	6	3
Don't know	17	9
NR	3	2
Can't say	1	1
Total	184	100.0

Fig. 137: Farmers’ perception on agricultural scientists – Farmers’ needs are met by the agriculture department

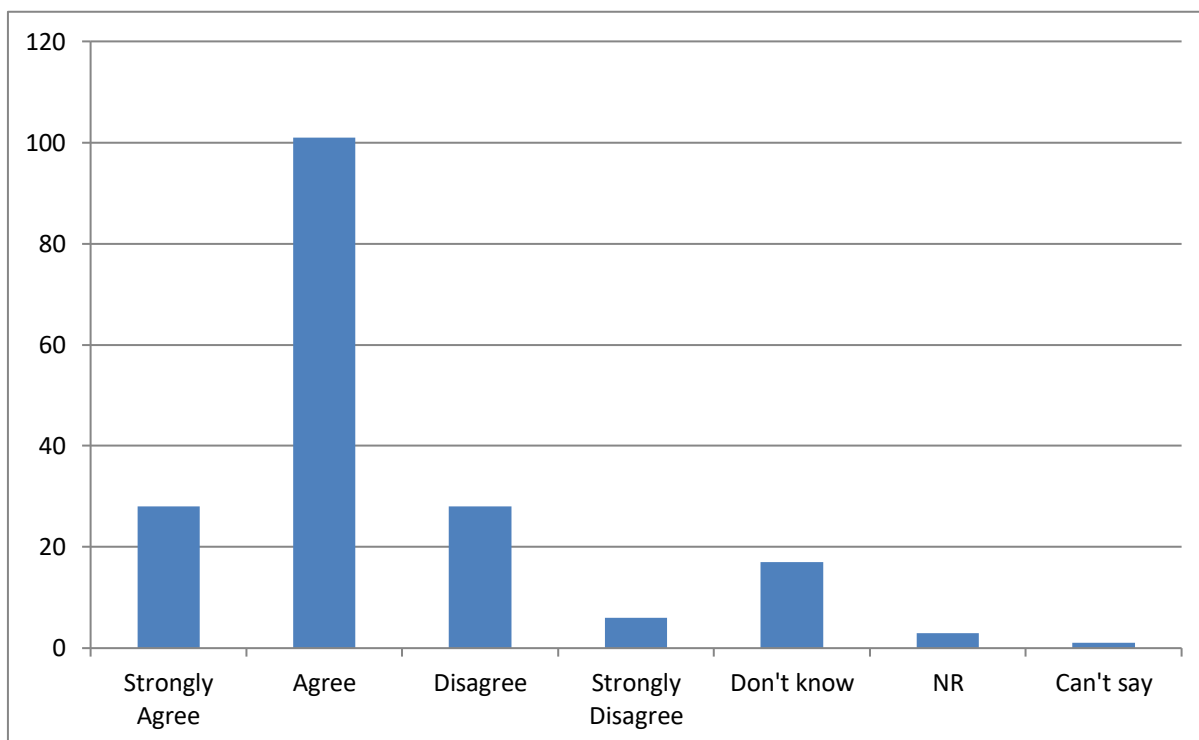
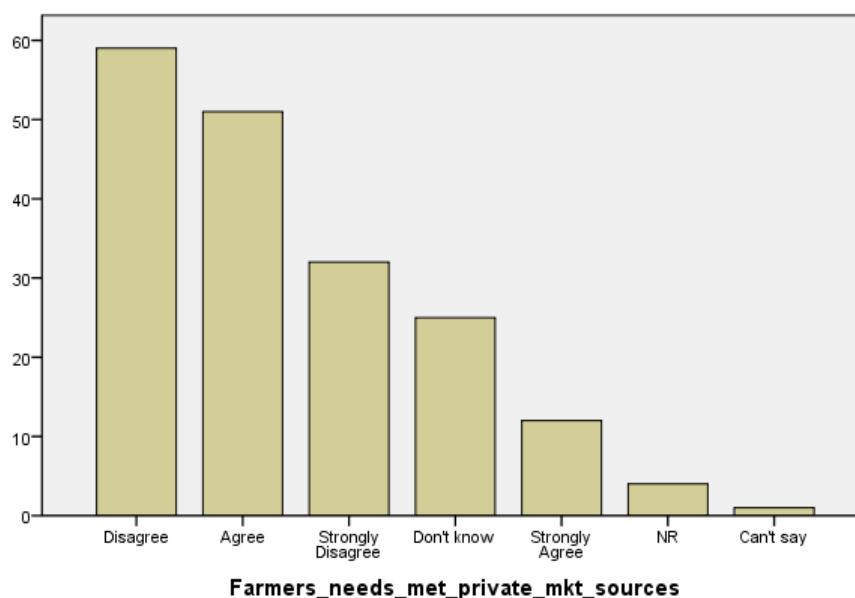


Table 144: Farmers’ perception on agricultural scientists – Farmers’ needs are met by the private market sources

Farmers needs are met by the private market sources	No. of respondents	Percent
Strongly Agree	12	6.5
Agree	51	27.7
Disagree	59	32.1
Strongly Disagree	32	17.4
Don't know	25	13.6
NR	4	2.2
Can't say	1	.5
Total	184	100.0

Fig. 138: Farmers’ perception on agricultural scientists – Farmers’ needs are met by the private market sources



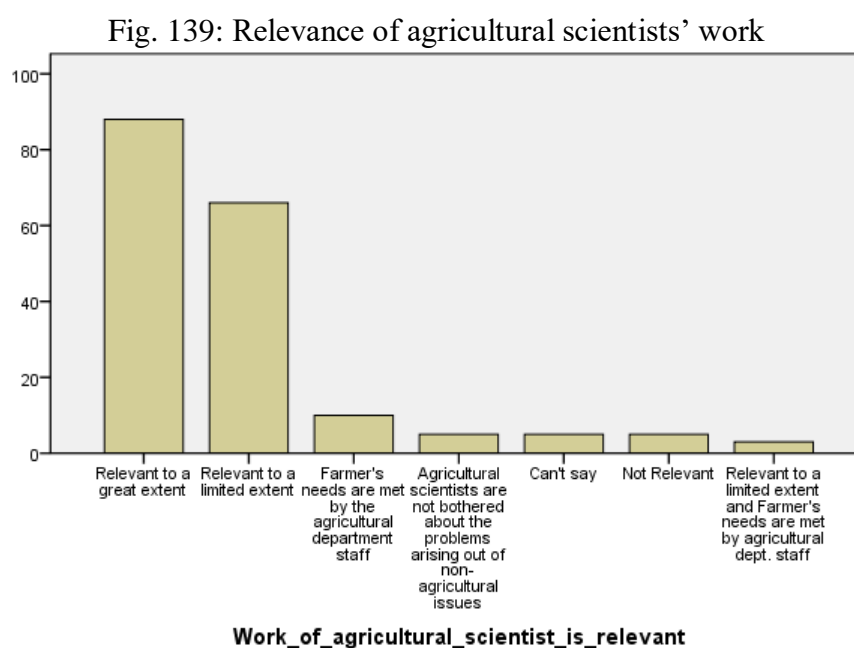
### Crop science research and the context

In an attempt at capturing the perception of scientists on the relevance of their work in overcoming the present agriculture crisis in which small and marginal farmers are suffering a lot, a question was posed. Responding to this about 48 percent of the scientists observed that their work is relevant to a great extent while 36 percent felt it is relevant to a

limited extent. Interestingly only about 6 percent observed that farmers' needs are met by the agriculture department staff (see Table 145).

Table 145: Relevance of agricultural scientists' work

Relevance of agricultural scientists' work in overcoming the present agriculture crisis	No. of respondents	Percent
Relevant to a great extent	88	48.4
Relevant to a limited extent	66	36.3
Farmer's needs are met by the agricultural department staff	10	5.5
Agricultural scientists are not bothered about the problems arising out of non-agricultural issues	5	2.7
Can't say	5	2.7
Not Relevant	5	2.7
Relevant to a limited extent and Farmer's needs are met by agricultural dept. staff	3	1.6
Total	182	100.0



### Crop sciences and social sciences

Development of new techniques of cultivation and generation of new agricultural knowledge is carried out by the scientists located in the relevant departments of agricultural science institutions while the dissemination and adoption of such knowledge and technologies falls in the social domain. Thus the component on social aspects, including cultural and economic are integral part of agriculture science curriculum. Over

the years extension departments in the agriculture universities evolved into units providing feedback to scientists working in the core department of agriculture from farmers. They became centres of felicitation of technology transfer and feedback. However, in the context of agrarian crisis, the social science departments in agricultural universities came under sharp criticism for their failure to provide necessary academic as well as research support to core agricultural science specializations.

Keeping this in mind, a set of questions was posed to the respondents to assess their perception on the social sciences in agricultural science research and teaching. Responding to the statement that ‘my area of research doesn’t need inputs from social sciences’ about 53 percent of the respondents disagreed (including strongly disagree and disagree responses) with the statement suggesting that their area of research require inputs from social sciences while 35 percent agree with it (see Table 146). Responding to the suggestive statement that inputs form social sciences are essential for their research, however, they find it difficult to get about 47 percent agreed while 31 percent disagreed (see Table 147). To another statement that inputs form social sciences are essential for their research, and they are satisfied about it 49 percent agreed while about 28 percent disagreed (see Table 148).

Table 146: Response on inputs received from social scientists in agricultural universities-  
Doesn’t need inputs

My area of research doesn’t need inputs from social scientists	No. of respondents	Percent
Strongly Agree	20	11.1
Agree	43	23.9
Disagree	74	41.1
Strongly Disagree	21	11.7
Don't know	12	6.7
NR	10	5.6
Total	180	100.0

Fig. 140: Response on inputs received from social scientists in agricultural universities-  
Doesn't need inputs

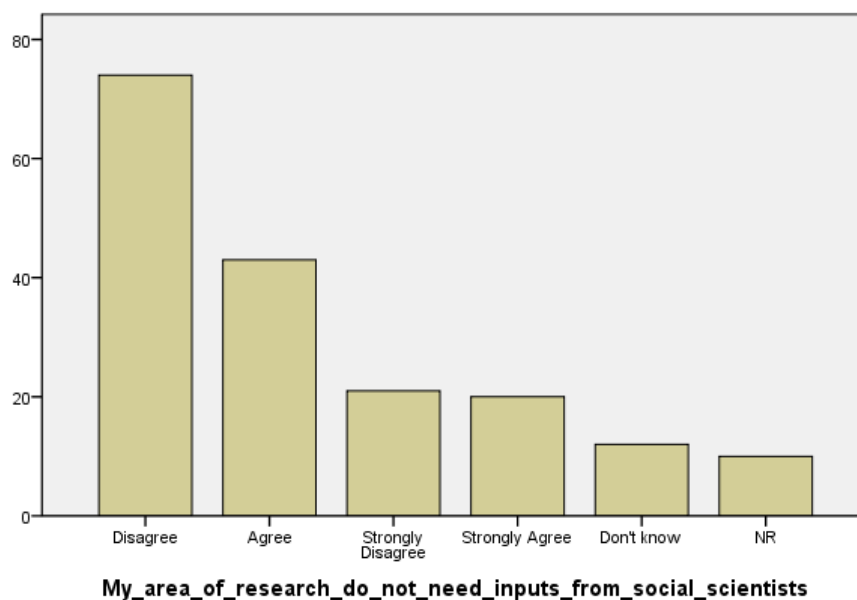


Table 147: Response on inputs received from social scientists in agricultural universities –  
difficult to get

Need inputs but difficult to get	No. of respondents	Percent
Strongly Agree	16	8.9
Agree	69	38.3
Disagree	52	28.9
Strongly Disagree	6	3.3
Don't know	22	12.2
NR	15	8.3
Total	180	100.0

Fig. 141: Response on inputs received from social scientists in agricultural universities - difficult to get

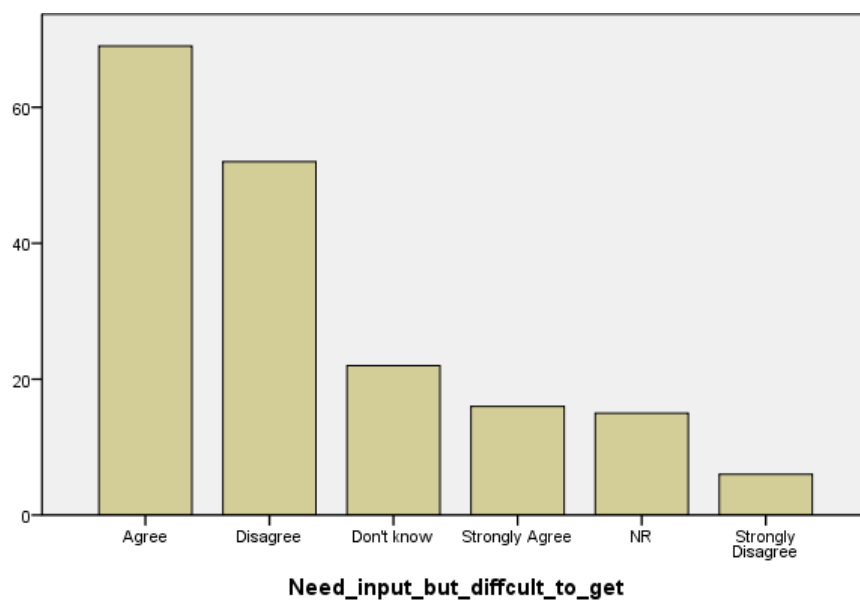
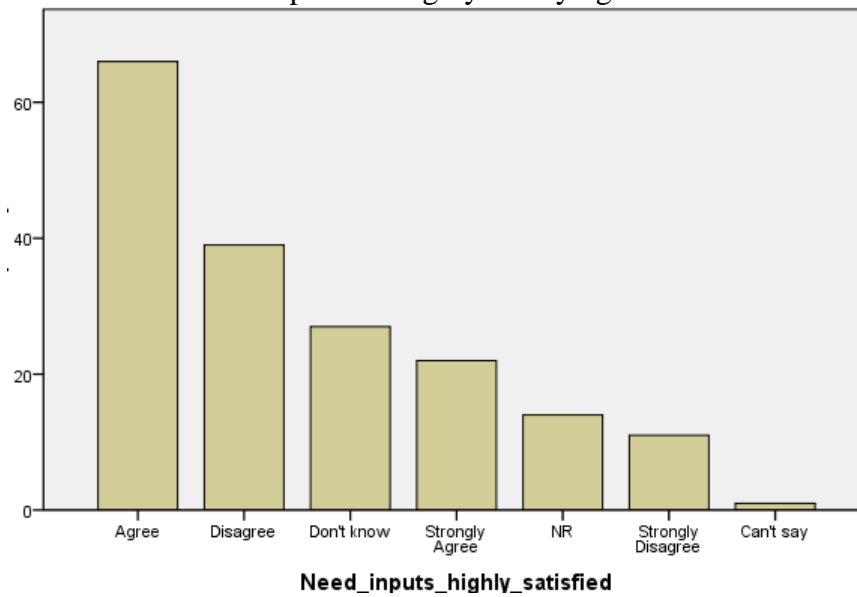


Table 148: Response on inputs received from social scientists in agricultural universities – inputs are highly satisfying

Need inputs which are highly satisfying	No. of respondents	Percent
Strongly Agree	22	12.2
Agree	66	36.7
Disagree	39	21.7
Strongly Disagree	11	6.1
Don't know	27	15.0
NR	14	7.8
Can't say	1	.6
Total	180	100.0

Fig. 142: Response on inputs received from social scientists in agricultural universities - inputs are highly satisfying



As mentioned, the role of social sciences is important in agriculture science research. Intending to know the perceptions of scientists on the status of social science in agricultural science institutions a set of statements was placed for response by the scientists. Responding to the statement that ‘social sciences are well grounded in agricultural universities’ about 62 percent of the respondents agreed while 24 percent disagreed (see Table 149). Responding to the statement that ‘social sciences enrich agricultural research’ a large majority (about 79 percent) agreed while only 9 percent disagreed (see Table 150). When asked whether ‘social sciences are weakly placed’ in the agricultural universities and institutes only 39 percent agreed while 44 percent disagreed (see Table 151). Another statement ‘social sciences do not offer a critical view’ was posed to the respondents and to which about 50 percent disagreed (see Table 152) while 35 percent agreed.

Table 149: Social sciences in the agricultural universities - well grounded in the agricultural universities

Social sciences are well grounded in the agricultural universities	No. of respondents	Percent
Strongly Agree	30	16.7
Agree	81	45.0
Disagree	36	20.0
Strongly Disagree	7	3.9
Don't know	14	7.8
NR	9	5.0
Can't say	3	1.7
Total	180	100.0

Fig. 143: Social sciences in the agricultural universities - well grounded in the agricultural universities

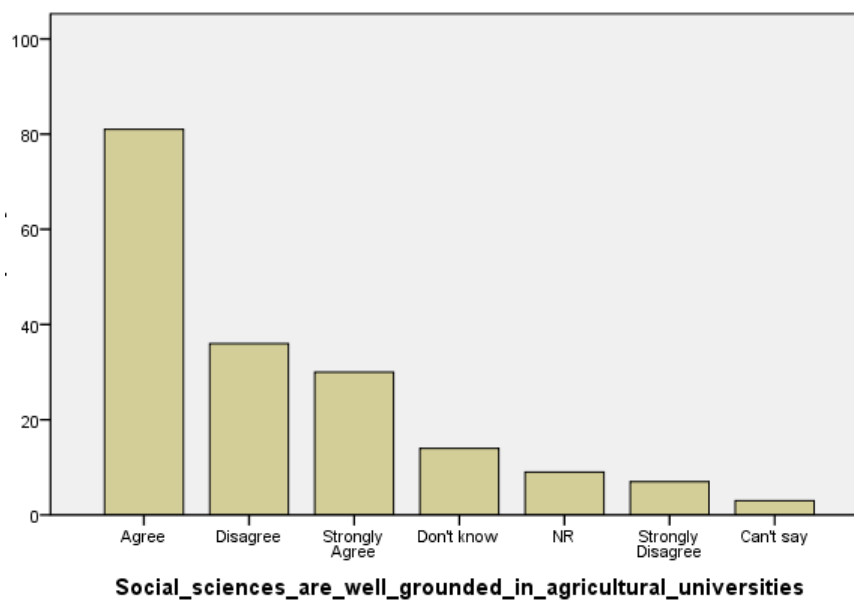


Table 150: Social sciences in the agricultural universities- enrich agricultural research

Social sciences enrich the agricultural research	No. of respondents	Percent
Agree	106	58.9
Strongly Agree	36	20.0
Disagree	12	6.7
Strongly Disagree	3	1.7
Don't know	12	6.7
NR	10	5.6
Can't say	1	.6
Total	180	100.0

Fig. 144: Social sciences in the agricultural universities- enrich agricultural research

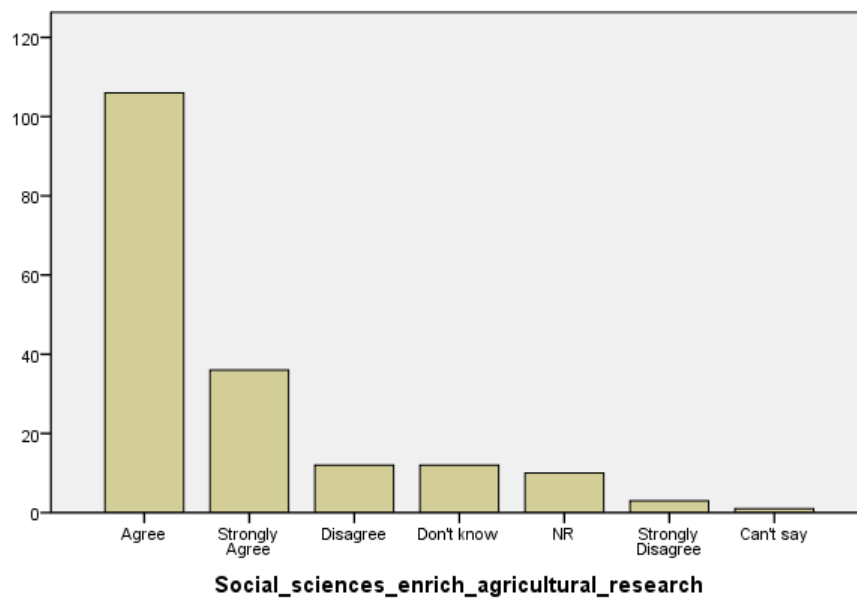


Table 151: Social sciences in agricultural universities- weakly placed

Social sciences are weakly placed	No. of respondents	Percent
Strongly Agree	20	11.1
Agree	50	27.8
Disagree	67	37.2
Strongly Disagree	13	7.2
Don't know	19	10.6
NR	10	5.6
Can't say	1	.6
Total	180	100.0

Fig. 145: Social sciences in agricultural universities- weakly placed

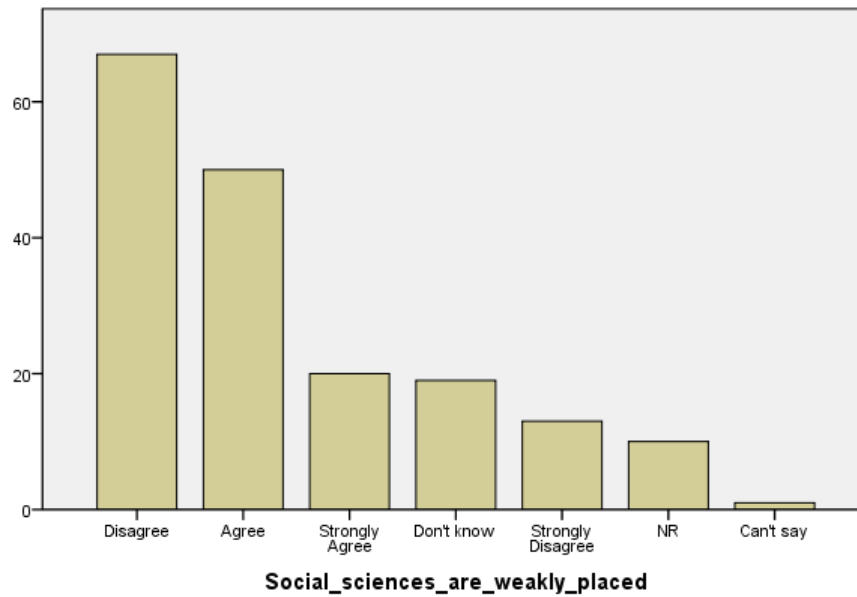
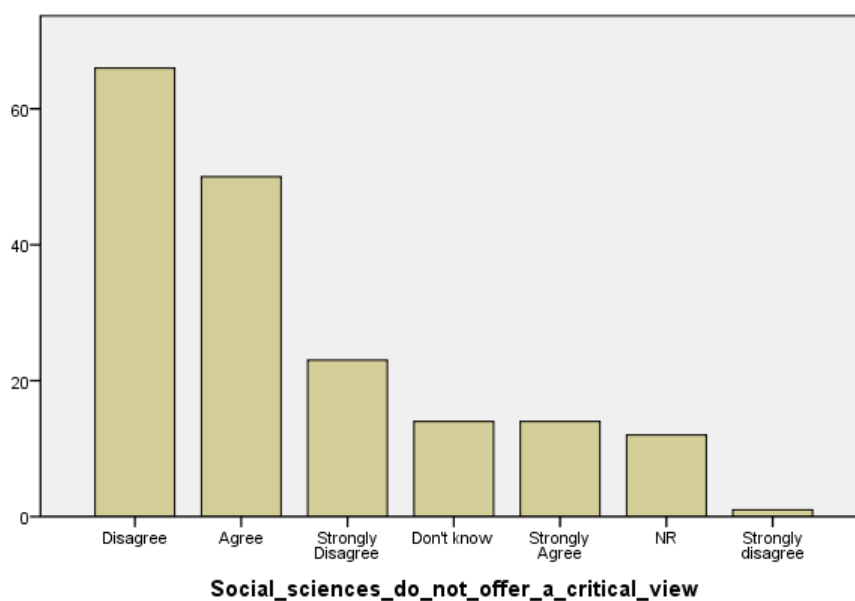


Table 152: Social sciences in agricultural universities- do not offer a critical view

Social sciences do not offer a critical view	No. of respondents	Percent
Strongly Agree	14	7.8
Agree	50	27.8
Disagree	66	36.7
Strongly Disagree	23	12.8
Don't know	14	7.8
NR	12	6.7
Strongly disagree	1	.6
Total	180	100.0

Fig. 146: Social sciences in agricultural universities- do not offer a critical view

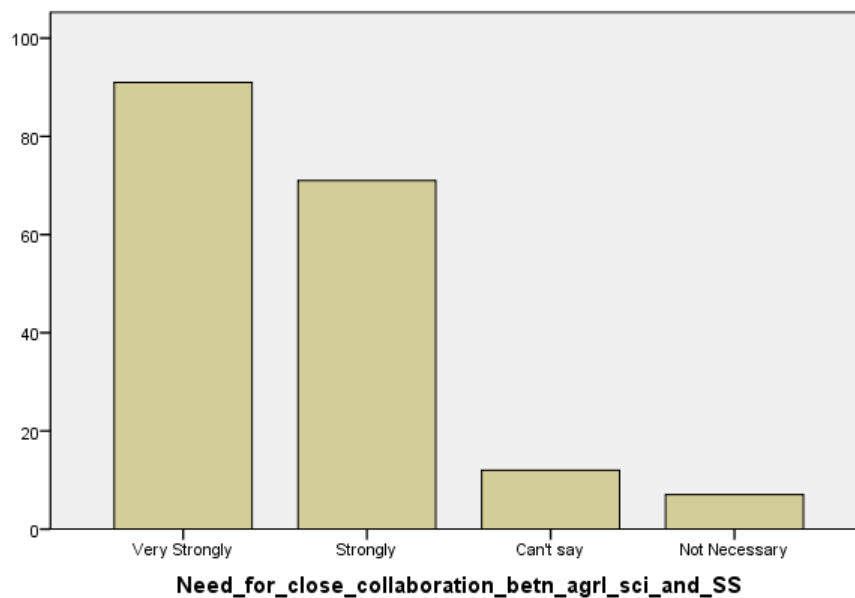


On the question of seeking responses on the need for close collaboration between agricultural sciences and social sciences a large majority of the respondents (about 90 percent) agreed with the statement that there is a need for close collaboration between agricultural sciences and social sciences (see Table 153).

Table 153: Collaboration between agricultural sciences and Social Sciences

Need for close collaboration between agricultural sciences and Social Sciences	No. of respondents	Percent
Very Strongly	91	50.3
Strongly	71	39.2
Can't say	12	6.6
Not Necessary	7	3.9
Total	181	100.0

Fig. 147: Collaboration between agricultural sciences and Social Sciences



### Crop sciences and the challenges to its paradigm

It was also observed that most of the scientists have an ‘opinion’ on alternative technologies, such as system of rice intensification (SRI), organic farming, etc. whose basis is no different from that of a lay person. What prevents these scientists from disproving the claims of alternate knowledge systems scientifically? Many scientists responded to this saying that the institution in which they are working has no such mandate although they are interested to do so. Even if someone is interested to take up, they are apprehensive about the prospects of funding. It was a general feeling that if any proposal for such research comes from the top it is easy to get funding for research. Otherwise not many are interested in risking their career in going about the research study

which is not to the likening of the head of the institution or the division. Some of the scientists who have developed curiosity for alternate claims expressed their inability due to the 'culture of science' in the agricultural research institutions.

A young scientist observes that 'for our career growth it is important for us to focus on the research projects which can get funding without much difficulty'. There is also a feeling that from time to time there is a shift in the 'popularity' of the research areas. Unfortunately, sometimes the 'popular research areas' are mooted by the international research community and other agencies and if the scientists at the top level are convinced about them then funding would be channelled to such areas of research. Continuing the probing, when it was asked, whether alternate systems of crop production would have greater acceptance for research funding had they been pushed by the international agencies, the response was overwhelmingly affirmative.

However, despite these issues some scientists from the research institutions worked from the beginning on some alternate systems like SRI and it may be said that their enthusiasm led to a considerable scientific scrutiny on SRI in India. However, each of their experiences is a learning to know how the culture of science operates in the scientific institutions. It was observed that 'extra-scientific' factors play a significant role in research in the institutions of science. 'Persons at the top' and his/her specializations and interests of research, convictions do matter in the research project initiations, approvals and support for funding.

A favourable person at the top, external funding (international), tie up with renowned funding or collaborative agency, had been reported as the factors which influenced the initial work of some scientists' work on SRI. They all claim that because of their personal conviction, they were enthused to try out SRI. Others suggested that the person at the top introduced them into the new research area. How was the reaction of their colleagues? The scientists recalled scepticism about such projects. It was revealed that SRI was hotly contested in the lobbies of these institutions, research seminars, funding board meetings, etc. However, over a period this opposition to SRI weakened as the discussion on SRI became intense in journals. Publication of findings in reputed journals has been one of the key factors in moulding the attitude of peer group towards SRI. Apart from this, invitation to present findings in international level and national level seminars was another factor that influenced the opinion of peer group members on SRI.

A retired scientist who pursued rigorous research on SRI contends that he went about giving doctoral research topics to his students on SRI even when there was a strong opposition to SRI in the academic circles. This observation points at the pressures of research that operate in the research institutions. It is important to withstand such pressures. He asserts that because he was convinced about the science of SRI he could strongly argue for research on SRI. Later on with huge funding from external sources, the credibility of research on SRI among the peer group members was established. In a way it suggests that the acceptance of a research concept among the peer group members is dependent upon the fellowships offered to students, funding from external sources etc. which in turn help in establishing the topic in agricultural research centres. Surely taking up research topics that raise critical questions at the dominant paradigm and still finding place in the agricultural research institutions is nothing but inviting hurdles. SRI is a case in point here.

#### **Chapter-IV: Crop science research and the challenges**

All knowledge, including scientific knowledge is socially conditioned (Bloor, 1976). The social function of science is to strive for the welfare of human society. Modern science, which emerged as the sole source of scientific knowledge, seen as a panacea for several problems humanity faces today. Crop sciences is no exception. Standing up to its proclaimed objectives the research outcomes in crop sciences saved the world from hunger.

However, the very solemn science underwent changes due to socio-economic and political factors of global nature. Science is no more a Mertonian institution rather evolved into an alibi of industry. Ziman (1996) articulates the shift from esoteric form of science to applied science calling the present day science as postacademic science. Crop sciences is facing the pressures from a different set of social actors whose interests lie in the markets. The sciences that worked for the common man and the poor farmer is now forced to address the needs of the forces operating the global political economy.

Barnes argues that goals and interests condition development of knowledge (Haribabu, 2004 quoting Barnes). Scientists bring the problems of the social world and work towards offering solutions. Thus the questions scientists raise, answers they seek, methods they use has social significance. This is because the resources and knowledge for crop cultivation are differentially available across small and big farmers. Solutions found for problems of small farmers may be relevant for big farmer but not vice-versa. Hence, the interests and meanings scientists attach to problems in cultivation matter to social scientists as to know whether the problems of small and marginal farmers, farmers from lower social order and women are considered for research. Given the context, how crop sciences in the country is looking at the wider context of cultivation from within and without is to be understood. Embarking on this larger objective, the present study initiated the interaction with crop scientists located in different universities in the country.

The aim of the study was to understand the extent to which agricultural science is responsive to the fast paced developments occurring in the larger social milieu. If it is responsive, how the issues are translated into research agendas of the scientists in the state agricultural institutions. Based on these objectives, the study was undertaken to understand

what scientists perceive about crop science research vis-a-vis the emerging social reality in the country.

### **Perceptions of scientists on crop science research in India**

The study ascertained the opinions of scientists on the objectives scientists keep in mind while formulating the research problems. The perception of scientists towards the objectives of their research was measured through the ranking they gave for a set of objectives, ranging from productivity to technology generation. Among these objectives problem solving emerged as the highest ranking objective followed by productivity. It is important to note that for a significant number of respondents (about 46 percent) publication of papers through research is not a preferred objective.

Agriculture science emerged as a discipline of its own attracting young to pursue it as a career. The standards of evaluation of performance, typical to that of any academic science, mandate scientists in the agricultural institutions to fulfil the minimum criteria for promotion to a higher level in their career ladder. Governed by the universal standards of appraisals, publications is an important category for agricultural scientists too.

Although scientists ranked publications as the not so important objective kept in mind while formulating the research proposal the importance of publications came out in the informal conversations with the researcher. It may be mentioned that, during their interaction with the researcher, a significant number of scientists expressed their reservations about the standards of performance evaluation presently followed by the agriculture institutions. The bone of contention is that the present evaluation criteria privilege publications over extension or problem solving work of the scientists. Being an applied science, and influenced by the problems farmers face, many a times scientists choose to work on a problem that provides immediate answers to some challenges of the farmers. Same is the case with transfer of technology. However, such works are not given due weightage in the evaluation. In fact this trend indicates the tendency of agricultural sciences, the discipline that has to work with farmers and for farmers, moving away from field to lab. Some suggest that the new generation of scientists recruited are not from agriculture families, which was the case about two decades back, and would like to seek research questions that can lead to publications. Moreover, the new recruits are more interested in publications for career growth rather than problem solving.

The social context of cultivation in India is undergoing change. A large number of farmers operate small holdings. They belong to the lower strata of society. The biggest challenge before the state, policy makers, crop and social scientists is to how to make the small holdings sustainable for socially and economically poor farmers like dalits, tribes and women. Assumptions of trickle-down effect, scale neutrality of agricultural technologies are debunked. Widespread agrarian distress, increasing vulnerability of these sections of farmers is the present day reality.

Modern science proceeds with objective understanding of phenomena. Crop science research assumes that the methods of its science place it above subjective interpretations of reality. However, given the fact that farming or cultivation and the output in the form of yield and productivity are subjective phenomena influenced by the social, economic and political factors of cultivation scientists must formulate the objectives accordingly. In the emerging reality of 'dalits, tribes and women farmers' the objectives of research must rise above the linear methods of research. In an attempt to understand the perceptions of the scientists they were asked whether they consider the social differentiation of farm holdings as an essential part of the research process. A majority of the respondents don't consider it as relevant, however, a significant number of respondents (about 42 percent) believe that social differentiation along caste and gender lines is relevant in the formulation of research problem. Again a significant number of respondents (about 44 percent) consider social differentiation is relevant in developing new technologies while majority respondents (about 54 percent) consider social differentiation is relevant for conducting field demonstrations. With reference to developing new varieties about 34 percent felt that social differentiation is relevant. Findings suggest that a significant number of respondents, although in minority, believe that cognizance of social differentiation along caste and gender lines in agricultural research is relevant in the formulation of research problem.

It was also attempted to know to what extent the structural differentiation (along the lines of land holding, which is categorised into marginal, small, medium, semi-medium and large farmers) of farmers influences the formulation of research problem. About 46 percent found that consideration of structural differentiation in the formulation of research problem is most relevant. On the consideration of structural differentiation in conducting field demonstrations about 52 percent of the respondents observed that it is

most relevant. It may be surmised that although structural differentiation plays an important role in the formulation of research problem social differentiation is also gaining importance.

On the issue of social and structural differentiation being considered by the scientists in the formulation of research problem data suggests that structural differentiation is considered more than social differentiation. The reason may be due to the very strong bearing of agricultural economics on the agricultural sciences. Agricultural economists have been working with class category since a long time and hence land holding has become an essential category in research. Will it become an acceptable category for research in agricultural sciences if farmers are categorized on the basis of caste? This may be possible with the active engagement of Sociologists along with agricultural extension specialists in the departments of agricultural science. The emphasis on such perspective is not aimed at bringing political orientation to research but to highlight the fact that social and cultural aspects of farmers do influence their access to knowledge, disposition to new technologies and orientation to put the technologies to better use. It may be mentioned here that a small or marginal farmer belonging to upper caste may become the natural choice of agricultural researchers for their various kinds of interaction rather than a dalit farmer.

Reacting to the problems associated with agricultural research majority of the respondents felt that lack of trained laboratory staff has been the major problem in conducting research. Lack of skilled workers, lack of motivated students and lack of funding for research area of one's interest are the other issues of concern emerged from the study. The study finds that scientists consider problem solving as the most important objective considered while formulating the research questions. Majority of the scientists reported to enjoy autonomy in formulating research problems to a great extent, however, a significant number (about 30 percent) felt the autonomy was limited.

Academic science is largely state funded in India. Agricultural science is no exception to this. Science seeking solutions to the problems faced by farmers has been the top priority of the state in terms of funding. During the green revolution phase the state funding to research in agricultural sciences was the only source. However, over a period, with changes in the macroeconomic structure in the country and changes in the trade and commerce worldwide, the entry of private corporate institutions into Indian agriculture is

being witnessed. Since then, research in agriculture began to receive funding from both national and international, and public and private sources as well.

Responding to the issue of funding for research a significant number of respondents (about 34 percent) noted that they didn't receive funding of their choice of research because their research problem was not fitting into the institution's mandate. Similarly, about 53 percent agreed to the statement that they did not receive funding of their choice because the research topic doesn't suit the mandate of the funding agency. However, a large majority of the scientists were satisfied with the research problem they are handling. Responding to the statement whether scientists ever had a research problem that contradicted the institutions' research mandate about 13 percent of the respondents (24 scientists) stated that they had a research problem that doesn't fit the institute's research mandate. Also, 21 scientists, out of 38 who responded to the statement that 'incompatible with the priorities of the institute' as the reason for non-suitability of research problem, agreed with the statement. This suggests that funding for research project is approved for those which are identified for research by the institute (thrust areas), which fit into the mandate of the institution and its priorities, and also which fit into the funding agency's mandate. It is also important to note that there are scientists who wish to work in the areas beyond the institution's mandate and which don't fit into the institution's priorities and their project proposals are not approved for funding. This highlights the normative structure of research funding process in agricultural science research institutions.

Crop science research is standardised in terms of methods used. Hence, research proposals going beyond the standard methods are denied funding. This was reported by a significant number of respondents (although in minority, about 20 percent) who stated that there is a general tendency of denial of funding if the research problem and the methods adopted don't follow the established standards. Also, about 27 percent respondents agreed to the statement that funding was not received because the outcomes of the research are not visible or measurable using the positivist methods of research. This was also expressed by the scientists who were working on issues like system of rice intensification (SRI), organic farming, etc. in their personal interviews. A scientist working on organic farming, observed that 'it was difficult for me to show the immediate results of organic farming,

say in one season, as the beneficial impacts are felt over successive seasons. Hence the board used to put hurdles on research funding. I had to work hard to convince them’.

### **Perceptions of scientists on the interaction with farmers**

Research in crop sciences requires constant interaction with farmers. In the early phase of green revolution agricultural scientists brought problems of farmers from the field and worked extensively to provide solutions. The nature and intensity of interaction of scientists with farmers during the green revolution phase was exemplary. Hence it may be said that agricultural research contributed immensely to the nation’s goals. However, over a period there appears to be a growing gap between scientists and farmers.

Personal interaction with the scientists by the researcher during the study revealed that prior to liberalization or before the entry of private players into agriculture the agricultural scientists had a close interaction with farmers. Such interaction, claimed to have provided agricultural scientists the opportunities to take up issues of farmers’ concern for research or fine-tune their research priorities. In the evolving context the nature of interaction with farmers has been changing. The survey data on this reveals that a majority of the respondents interact with farmers at least once a month and have no issues with regard to feedback from farmers. However, few scientists (about 28 percent) expressed concern over it. Data also suggests that majority of the respondents give importance to interaction with farmers as the scientists will be able to know the problems of farmers directly.

The study also explored the nature and intensity of interaction between farmers and scientists. Majority of the scientists expressed satisfaction over their interaction with farmers as they come to know about farmers’ problems directly. Also it was noted that scientists derive satisfaction through their interaction with farmers as they get inputs for further research. As regards the sources of inspiration for research problems a majority of the scientists are inspired to work for commercial application of their research outcomes. On the question of preferred stage of interaction with farmers a large number of scientists mentioned the research problem formulation stage as the most preferable stage of interaction with farmers.

Scientists observed that farmers are enthusiastic to learn and to seek advices from scientists. To what extent farmers take scientists suggestions seriously? Responding to this

a large majority of the scientists observed that farmers take scientists' suggestions seriously. A large majority of the respondents prefer approaching farmers directly for feedback rather than depending on agriculture department personnel. Data suggest that the least preferred source for obtaining feedback from farmers is through local leaders.

### **Reflections on contemporary agriculture in the country**

Acknowledging the fact that green revolution benefitted the nation enormously the present study attempted to know the perceptions of scientists on the different aspects of the benefits of green revolution. Responding to the statement that green revolution increased yields a large majority of the respondents (about 82 percent) considered it as the most agreeable contribution and viewed that green revolution benefitted nation and farmers. At the same time, they also acknowledged that green revolution added to the problems of the environment.

In the past three decades agriculture in India underwent structural changes manifested in the changing demographic profile of farmers, spread of green revolution to arid regions and withdrawal of state from agriculture extension, etc. In the context of rapidly changing agrarian situation in the country which is marked by the large presence of small and marginal farmers belonging to the lower strata of society, declining state support in input delivery and extension, entry of private players into agriculture inputs market, poor administrative monitoring mechanism and most importantly, the resource poor (economical, social and cultural resources) farmers taking up agriculture in a big way, it is suggested that the agricultural scientific community must respond and do the needful. Given the context the study attempted to understand the perceptions of the crop scientists on the emerging agrarian reality. The study finds that scientists prioritise productivity increasing research outcomes, and sustainable research outcomes as the most relevant for the agricultural science research today. Interestingly, about 37 percent of the respondents considered that small and marginal farmer friendly research outcomes as most relevant. Scientists view that they have a greater role in taking the research findings to the farmers. They also observe that the state should not withdraw from agriculture and should not leave it private players.

State has been instrumental in bringing success during the green revolution phase. However, owing to changes in the wider context, state's role in agriculture appears to be

declining. Reflecting on this, scientists favour an active role of state in agriculture today. With regard to the role of private players in agriculture about 41 percent of the respondents favour the participation of private players in agriculture in the country. Majority scientists also agree that the state institutions are lagging behind private research institutions in the country. At the same time they suggest to not to leave agriculture to the private market forces.

As regards the perception of scientists on the problems plaguing agriculture today study finds that a majority of the respondents view lack of remunerative price for farm products as the most important problem faced by farmers followed by problems related to agriculture markets, availability, quality and cost of agriculture inputs and depleting water resources. Responding to the question on the important contributions of state agriculture research institutions in the last ten years majority of the respondents suggested development of new high yielding, disease resistant, improved varieties of seeds as the most important contributions. This is followed by technology transfer and the contributions in the field of integrated pest management. Reflecting on the important contributions of private agricultural science research in the country majority of the scientists observed that improved, high yielding, pest and disease resistant seed varieties as the most important contributions. This is followed by advancements in molecular biology leading to development of new transgenic variety seeds like Bt cotton and development of new pesticide formulations using newer molecules to control pest and diseases.

### **Perception of crop scientists on agrarian crisis in India**

Farmers' suicides reflect the pathological status of agriculture in the country. Although it is difficult to single out a particular social institution, but necessarily, different institutions that work to provide equitable space for every individual to live with dignity have failed to perform. In this sense agricultural research and teaching institutions of the country cannot remain as bystanders. In the light of this situation, it was attempted to understand how the scientific community views the evolving agrarian crisis in the country and where does agricultural science stand in this unfolding scenario. The study finds that majority of the respondents believe agricultural science research in the country addresses farmers' problems.

Study also finds that scientists believe government failed to take technologies to farmers. They also believe that suicides are not related to agricultural problems rather resultants of other factors like credit and market prices. The scientists view that farmers are not trained to use the agricultural technologies.

One of the important problems of agriculture in the country is the wide gap between the recommended field practices (called as best management practices) by the scientists and the actual practices of farmers. Scientists observe that farmers do not follow the recommended practices as suggested by the agriculture extension specialists. They view that farmers don't follow appropriate seed rate, appropriate fertilizer dosage and pesticide dosage. Perception of scientists on the magnitude of gap between recommended practices and farmers practices the study finds that the gap is between 30 to 60 percent.

At a time when the linear positivist methods of research are contested even in sciences, crop science research is no exception. Advocates of non-linear, non-positivist and non-essentialist research in crop sciences argue for looking beyond the tangible outcomes or measurable outcomes. It is essential to reformulate the methods as well as research questions. This new paradigm calls for participatory research involving farmers at every stage of research process. The research questions must be drawn from the end users' anxieties so that the outcomes will be of use to them. The research agendas should not only address the problems of productivity and efficiency but also relevant at the small and marginal farmers' context. Echoing this, majority of the respondents (about 58 percent) observe that yield alone should not be considered as the sole parameter for recommendation to farmers, although they also believe that increasing yields is the primary concern of agriculture. The study finds that a majority of the respondent scientists view farmers' traditional knowledge is relevant to a great extent addressing the problems of agriculture at the small and marginal famers' level. Similarly a significant number of respondents (about 41 percent) believe that farmers' traditional knowledge is relevant to a great extent at the socially backward farmers' level. The study, however, finds that a majority of the respondent scientists perceive farmers' traditional knowledge is relevant to a limited extent in increasing yields and in overcoming the problems of agriculture today. Data on the areas of research which attracted scientists' attention in the last ten years reveals that biotechnology and climate change related topics emerged as the high priority

areas while seed production, traditional knowledge related research projects received very low priority.

Scientists perceive that farmers still rely on agricultural scientists for suggestions, however, also recognize that ‘farmers are in need of information but scientists are not accessible’. Interestingly, scientists concur with the statement the farmers’ needs can be met by the private market sources also. Scientists reposed faith in the crop science research when they affirmed that their research is relevant to a great extent in overcoming the present agriculture crisis in which small and marginal farmers are suffering a lot.

### **Perceptions on crop sciences and social sciences**

It is a well known fact that agricultural sciences in the country grew in strength since independence and diversified into different specializations offering solutions to problems related to yields, efficiency, etc. When it comes to the application, adoption and evaluation of technologies, social science component of agricultural science is claimed to have provided relevant support. Thus the component on social aspects, including cultural and economic are integral part of agriculture science curriculum. However, in the context of agrarian crisis, the social science specializations located in agricultural universities came under sharp criticism for their failure to provide necessary academic as well as research support to the core agricultural science specializations.

The study finds that a majority of the respondents believe that their area of research require inputs from social sciences. At the same time they also felt that the inputs from social sciences are not satisfactory. Analysing the reasons, majority of the scientists respondents believe that ‘social sciences are not well grounded in agricultural universities’. A large majority of the respondents concur with the statement that ‘social sciences enrich agricultural research’, however, they are weakly placed in agricultural universities and institutes. The scientists find that social sciences do not offer a critical view. The crop scientists who responded to the survey believe that there is a great need for close collaboration between agricultural sciences and social sciences.

## **Culture of crop science research**

Apart from the survey questionnaire data were also collected through in-depth interviews with scientists located across the country selected through snowball sampling. This attempt was basically aimed at understanding the issues concerning alternate knowledge claims. It may be said that most of the scientists interviewed suggested that the alternate knowledge claims cannot be taken for granted and thus cannot be trusted. To the question that why is it that these knowledge claims have not been scientifically rebutted, majority of the respondents observed that the institution in which they are working has no such mandate, to test the claims. Even those scientists who were interested to take up were apprehensive of the prospects of funding. They felt that if such agenda comes from the persons at the top in the research funding institutions it would be easy to conduct research in such areas. In the absence of such push from the top, many expressed the opinion that they cannot risk their career in going about a research study which is not to the liking of the Head of the institution or division. Some of the scientists who have developed curiosity for such alternate claims as SRI or organic farming expressed their inability due to the 'culture of science' prevailing in the agricultural research institutions. A young scientist observes that 'for our career growth it is important for us to focus on research projects which can get funding without much difficulty'. There is also a feeling that from time to time there is a shift in the 'popularity' of research areas. Unfortunately, sometimes the 'popular research areas' are pushed by the international agricultural research organizations and other agencies and local issues seldom receive their attention. They also felt that scientists at the top are more convinced about a research area when it comes from the international organizations than when it evolves from local contexts. Continuing the probing, when it was asked, whether, for example, SRI or organic farming would have greater acceptance for research funding had it been pushed by international agencies the response was overwhelmingly affirmative. This surmises the fact that agricultural research in the country, in its pursuit of transnationalist agenda, has been oblivious to the emerging needs of the country.

The study finds that despite limitations some enthusiastic scientists worked on certain alternate knowledge claims like SRI. Such enthusiasm in fact led to considerable scientific scrutiny of SRI in India. However, each of their experience is a learning to know how the culture of science operates in scientific institutions. It was observed that 'extra-

scientific' factors play a significant role in research in the institutions of science. 'Persons at the top' and their specializations and interests of research, their convictions do matter in the research project initiations, approvals and support for funding. A favourable person at the top, external funding (international), tie up with renowned funding or collaborative agency had been reported as the factors which influenced the initial work of some scientists on SRI. They all claim that because of their personal conviction, they were enthused to try out SRI. These scientists recalled that their peer group was sceptical and often ridiculed such studies. They observe that SRI was hotly contested in the lobbies of their institutions, research seminars, funding board meetings, etc. However, over a period the opposition to SRI weakened as the discussion on SRI became intense in journals. Publication of findings in reputed journals has been one of the key factors in changing the attitude of peer group towards SRI. Apart from this, as invitations from international and national conferences to share their findings started pouring the opinion of peer group changed significantly.

A retired scientist who pursued rigorous research on SRI contends that he went about giving doctoral research topics to his students on SRI even when there was a strong opposition to SRI in the academic circles. He points out that pressures operate in a research institution and it is important to withstand such pressures. He asserts that because he was convinced about the science of SRI he could strongly argue for research on SRI. Later on when he received huge funding from external sources the credibility of research on SRI among the peer group members was established. In a way it suggests that the acceptance of a research concept among peer group members is dependent upon the fellowships offered to students, funding from external sources etc. which in turn help in establishing the topic in agricultural research centres. However the scientist felt that 'surely taking up research topics that raise critical questions at the dominant paradigm and still finding place in the agricultural research institutions is nothing but inviting hurdles'. SRI is a case in point here.

## **Conclusion**

The findings of the study suggest that there appears to be a general agreement in the scientific community, cutting across disciplines, vis-a-vis the concerns of farmers in the country. This is evident when the views are shared during the in-depth interviews and also as presented in the survey analysis. However, there also appears to be certain

epistemological issues along with structural factors which make it difficult for the scientists to pursue research on the alternate technologies. This is amply evident in the case study on SRI. Given the normative framework within which agricultural science research is carried out, any expectation of critical admission and also the pursuit of research in that direction will be unrealistic. It is therefore believed that there is a need for reflexivity in agricultural sciences.

Based on the observations in the study it may be said that the agricultural scientific community is not always against pursuing research in the areas of interest to small and marginal farmers. However, it is admitted that the norms that govern research funding and priorities set by the institutions often act as hurdles. For example, some scientists admit that certain research questions they have in mind, how relevant they may be, given the space and time, may not fit into the research mandates of the institutions. This raises the concerns on science becoming dogmatic. Openness, flexibility, freedom with accountability may be the need of the hour.

The study reveals that there is a lack of institutional thrust to focus on the alternatives to mainstream models of knowledge generation in crop sciences. Empiricist, positivist methodologies dictate the standards of merit of a practice, thus nullifying any innovation outside it. It is being felt that the institutional response to it should be democratic, liberal, constructivist and inclusive.

### **Recommendations**

Crop sciences view farmers as passive agents who readily adopt new knowledge replacing old knowledge. Instead of testing the scientific basis of conventional knowledge the institutions of science, rubbish, ignored and never bothered to integrate new knowledge with the historical bases of knowledge. The need for a new paradigm of socially responsive crop science research and revised assumptions (of farm and farmer) has become imperative. It is being increasingly realized that the institutions of crop science should consider the changing demographic profile of farmers, emerging alternative knowledge claims, concern over climate change and contemporary agricultural context in the neo-liberal state. Crop sciences could work towards democratic, liberal, constructivist and inclusive knowledge forms eschewing linear, positivistic, methodologies to make agricultural still relevant at the small and marginal holdings.

Democratization of crop sciences is the need of the hour for it promises to bring the concerns of vulnerable sections of farmers into the research agenda rather than market interests. Reconfiguration of research agendas, practices and methodologies is possible when the crop sciences in India allies with farmer and farming communities. In the era of knowledge society the only section that is knowledge disempowered is farming community of certain regions and farmers belonging to certain castes. Establishment of agricultural knowledge commission with an aim to promoting localized, plural knowledge forms could help in guiding the efforts of crop science endeavours to overcome climate change.

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## Survey on perceptions of scientists from state institutions of agricultural sciences on crop science research and the contemporary agriculture in India

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You are aware of the immense contribution of agricultural sciences to India's growth in crop production. However, over a decade and a half we have been witnessing serious challenges to agriculture in the country in terms of farmers' suicides, large number of small and marginal farmers, high cost external input intensive agriculture, etc. There have been several research initiatives coming from scientists located in agricultural universities and research stations across the country to meet these challenges. In this context the present study aims to

- understand your experiences with relation to the nature and concerns of crop science research in Indian agricultural research institutions/universities
- know your perceptions towards crop science research programmes and policies in the country
- understand your reflections of current agricultural scenario with specific focus on agrarian crisis in the country

This survey is purely meant for academic purpose and the information provided by you will not be used for other than the said purpose. Your response would go a long way in the successful completion of the project. Identity and views expressed in this survey are protected.

1. Name (Optional): \_\_\_\_\_

2. Gender : Male \_\_\_\_\_ Female \_\_\_\_\_

3. Academic Qualifications: \_\_\_\_\_

4. Total years of service: \_\_\_\_\_

5. Designation (ex: Senior Scientist/Scientist/Professor etc.) \_\_\_\_\_

6. Years of service in the present designation (in number of years) \_\_\_\_\_

7. Areas of Specialization: \_\_\_\_\_

8. Department: \_\_\_\_\_

9. Research Projects: Please choose (tick) only one answer on each row				
	Not handling any project now	1 Project	2-4 Projects	More than 4 Projects
I am the Principal Investigator in				
I am a member of a research project team (e.g. All India co-ordinated research project)				

<b>10. Name the broad areas of the research problems you are currently handling (related to your project)</b>
1.
2.
3.
4.
5.

<b>11. What is the source of inspiration for the research problem you are handling? (you may choose more than one)</b>	
<input type="checkbox"/>	Drawn from earlier studies carried out by me
<input type="checkbox"/>	Drawn from earlier studies carried out by others
<input type="checkbox"/>	Some fellow scientists of the country suggested the problem
<input type="checkbox"/>	Some fellow scientists outside the country suggested the problem
<input type="checkbox"/>	Drawn from regular interaction with farmers
<input type="checkbox"/>	Institution's thrust area
<input type="checkbox"/>	Drawn from regular interaction with industry

<b>12. How are the research areas or sub-areas identified?</b>					
<i>Please choose (tick) only one response on each row</i>					
	Strongly Agree	Agree	Can't say	Disagree	Strongly Disagree
I generally arrive at the problem based on my conviction					
Institution plays a significant role in identifying the research problem					
Government priorities play a significant role in identifying the research problem					
Concerns of the industry play a significant role in identifying the research problem					
Farmers concerns play a significant role in identifying the research problem					
Priorities of the funding agencies play a significant role in identifying the research problem					

<b>13. To what extent do you rely on the following sources for arriving at your research questions?</b>					
<i>Please choose (tick) only one answer on each row</i>					
	Strongly Agree	Agree	Can't Say	Disagree	Strongly Disagree
Gaps in the present literature					
Questions encountered in the field					
Potential for commercial application					

**14. What are the broad objectives kept in mind while formulating the research problem?**  
*[Please rank the statements in order of your preference from 1 to 6 with 1 being the most preferred and 6 being the least preferred objective. Please do not use the same ranking for two options] Please choose (tick) only one response on each row*

	1	2	3	4	5	6
Productivity						
Yield efficiency						
Problem solving						
Publication of papers						
Leading to further research						
Technology generation						

**15. In your opinion, what is the extent of autonomy you enjoy in formulating your research problem?** *Please choose (tick) only one response from below list (Single Choice)*

<input type="checkbox"/>	To a great extent
<input type="checkbox"/>	To a limited extent
<input type="checkbox"/>	Can't Say
<input type="checkbox"/>	I have no control over this

**16. To what extent do you consider the social differentiation of land holdings along caste and gender lines relevant (eg: Forward caste, OBCs, SC, ST and women farmers)?** *Please choose (tick) only one response on each row*

	Most Relevant	Relevant	Not Relevant
In formulating the research problem			
In developing new technologies			
In taking up collaborative project			
In developing new varieties			
In conducting field demonstrations			

**17. To what extent do you consider structural differentiation (large, medium, small and marginal farmers) of farm holdings is relevant?** *[Rank the statements in order of your preference from 1 to 5. 1 being the most relevant 5 being the least relevant option. Please do not use the same rank for two options] Please choose (tick) only one response on each row*

	1	2	3	4	5
In formulating the research problem					
In developing new technologies					
In taking up collaborative projects					
In developing new varieties					
In conducting field demonstrations					

**18. Have you received funding for research topic(s) of your choice?**

<input type="checkbox"/>	Yes
<input type="checkbox"/>	Not received funding for the topic of my interest

19. What could be the reasons for not receiving funding? Please choose (tick) only one response on each row					
	Strongly Agree	Agree	Can't Say	Disagree	Strongly Disagree
Doesn't fit into the institution's mandate					
Doesn't fit into the funding agency's mandate					
Body which looked into the proposal do not have adequate knowledge about the area/topic					
Proposed topic doesn't fit the standard research protocols					
Proposed topic was viewed as difficult to evaluate against its outcomes as the outcomes were somewhat intangible					
Proposed topic was considered but the board felt that it falls outside the agricultural science paradigm					

20. What do you think about the research problem you are handling? Please choose (tick) only one response on each row	
It is satisfactory because this is what I want to do	<input type="checkbox"/> Strongly Agree <input type="checkbox"/> Agree <input type="checkbox"/> Can't Say <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly Disagree
It is not satisfactory as I feel I could handle a better one	<input type="checkbox"/> Strongly Agree <input type="checkbox"/> Agree <input type="checkbox"/> Can't Say <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly Disagree

21. What are the problems associated with the conduct of research? Please choose (tick) only one response on each row					
	Strongly Agree	Agree	Can't Say	Disagree	Strongly Disagree
Lack of trained laboratory staff					
Lack of motivated students					
Lack of funding for area of my interest					
Lack of space for experimental plots and other facilities					
Lack of proper feedback from farmers					
Lack of skilled workers in the field to conduct experiment					

22. Did you ever feel compelled to conduct a research study which you thought was not of your choice? Please choose (tick) only one response	
<input type="checkbox"/>	Compelled
<input type="checkbox"/>	Can't Say
<input type="checkbox"/>	Not Compelled

<b>23. Generally did you come across instances where funding is not given because of the following reasons. Please choose (tick) only one response on each row</b>					
	Strongly Agree	Agree	Can't Say	Disagree	Strongly Disagree
Incompatibility of established research standards					
Incompatibility of objectives/goals of research					
Not scientific					
Origin of the problem is not rooted in agricultural sciences					
No visible outcomes					
Not significant in terms of country's priorities					

<b>24. Do you have a research problem that you feel may not fit into the institute's research mandate?</b>	
<input type="checkbox"/>	Yes
<input type="checkbox"/>	No

<b>25. If Yes, in what sense doesn't it fit? Please choose (tick) only one response on each row</b>					
	Strongly Agree	Agree	Can't Say	Disagree	Strongly Disagree
Incompatible with the established research standards					
Incompatible focus					
Incompatible with the funding agency's mandate					
Incompatible with the standard research protocols					
Incompatible with the existing standards of evaluation					
Incompatible with the priorities of the institute					

<b>26. Does your research require direct interaction with farmers?</b>	
<i>Please choose (tick) only one response on each row</i>	
<input type="checkbox"/>	Yes
<input type="checkbox"/>	No
<input type="checkbox"/>	Can't Say

<b>27. If Yes, what is the intensity of meeting farmers?</b>	
<i>Please choose (tick) only one response on each row</i>	
<input type="checkbox"/>	At least once a month
<input type="checkbox"/>	At least once a season
<input type="checkbox"/>	At least once a year
<input type="checkbox"/>	No interaction with farmers

28. How does the interaction take place? Please choose (tick) only one response on each row					
	Strongly Agree	Agree	Can't Say	Disagree	Strongly Disagree
I go to farmers whenever I am in a need to know from them					
Farmers come to my office/lab/field					
I interact with farmers whenever I go to villages or 'happen' to meet farmers					
I make it a point to meet farmers whenever they visit our institution on certain occasions like kisan mela or exhibitions etc.					
Contact farmers over phone					

29. How do you rate your interaction with farmers? Please select one of the following	
<input type="checkbox"/>	Satisfactory
<input type="checkbox"/>	Not Satisfactory

30. If satisfactory, why do you think so? [Please rate the following answers according to your preference on a scale of 1 to 5. 1 being the most satisfactory to 5 being the least satisfactory] Please choose (tick) only one response on each row					
	1	2	3	4	5
Farmers narrate their problems					
I get first-hand information					
I get inputs for further research					

31. At what stage would you like to have interaction with farmers? [Please give your preference for all the statements] Please choose (tick) only one response on each row			
	Most Preferable	Preferable	Least Preferable
At the research problem formulation stage			
At the end stage to conduct field trial/demonstration			
Continuously during the experiment			

32. What is your opinion about farmers? Please choose (tick) only one response on each row					
	Strongly Agree	Agree	Can't Say	Disagree	Strongly Disagree
Farmers are enthusiastic to learn					
Farmers receive new knowledge from scientists					
Farmers are not interested in agriculture					
Farmers are interested only in the inputs given free of cost					
Farmers are not very enthused to seek advices from scientists					

<b>33. Do you agree with the statement that 'farmers take scientists suggestions seriously'?</b>	
	Strongly Agree
	Agree
	Can't Say
	Disagree
	Strongly Disagree

<b>34. What sources you rely on for getting feedback from farmers? [Rank the statements in order of your preference] Please choose (tick) only one response on each row</b>				
	Directly approach Farmers	State department personnel help you to reach out to farmers	Rely on local leaders to reach out to farmers	Farmers give you feedback directly
Most preferred source				
Preferred source				
Least preferred source				

<b>35. In your opinion, what do agricultural scientists need to look at considering the current state of agriculture in India? [Rank the statements in order of relevance from 1 to 6. 1 being the most relevant and 6 being the least relevant option. Please do not use the same rank for two options]. Please choose (tick) only one response on each row</b>						
	1	2	3	4	5	6
Need productivity increasing research outcomes						
Need efficiency increasing research outcomes						
Need environment friendly research outcomes						
Need sustainable research outcomes						
Need small and marginal farmer friendly research Outcomes						
Need economically viable research outcomes						

<b>36. What is your opinion on the role of Government in agriculture? [Rank the statements in order of your agreement from 1 to 3. 1 being the most agreeable and 3 being the least agreeable option. Please do not use the same rank for two options]</b>					
<i>Please choose (tick) only one answer on each row</i>			1	2	3
Scientists have no role in taking the research findings to the farmers					
It is the state which has to take the research findings to farmers					
State should withdraw from agriculture and leave it to private players					

37. Do you think that the government should have a greater role in agriculture?			
<i>Please choose (tick) only one response on each row</i>		Yes	No
Yes, it should play an active role			
Yes, but it should limit itself to guiding and regulating the private efforts			
No, it should leave agriculture to the market forces			

38. Do you agree with the statement that Government institutions are lagging behind private research initiatives in agriculture today?	
	Strongly Agree
	Agree
	Can't say
	Disagree
	Strongly Disagree

39. What, in your opinion, are the most important problems faced by the farmers in the country today? <i>Please specify (in the order of decreasing importance).</i>	
1	
2	
3	
4	
5	

40. What are the most important problems faced by agricultural research in India today? <i>Please specify (in the order of decreasing importance)</i>	
1	
2	
3	
4	
5	

41. Name five important contributions from government agricultural institutions in the last ten years (in your area of specialization). <i>Please specify</i>	
1	
2	
3	
4	
5	

42. Name five important contributions from private agricultural research in the last ten years (in your area of specialization). <i>Please specify</i>	
1	
2	
3	
4	
5	

**43. What in your opinion are the reasons for farmer suicides in the country? [Rank the statements in order of agreement from 1 to 6. 1 being the most agreeable and 6 being the least agreeable option. Please do not use the same rank for two options]**

*Please choose (tick) only one response on each row*

	1	2	3	4	5	6
Agricultural science research do not address their problems						
Government failed to take the technologies to the farmers						
Suicides are not related to agricultural problems						
Farmers are not trained to use the agricultural technologies						
Other factors like credit and market prices are the reasons						
We as agricultural scientists have no clue about the reasons for suicides						

**44. What is your opinion on Green Revolution? [Rank the following options in order of agreement with the given technologies from 1 to 4. 1 being the most agreeable option and 4 being the least agreeable option. Please do not use the same rank for two options]**

*Please choose (tick) only one response on each row*

	1	2	3	4
Increased yields				
Added to the problems of the environment				
Benefited farmers				
Benefited nation				

**45. Do you think that farmers follow recommendations by the agricultural scientists/department officials/extension staff with regard to the following practices?**

*Please choose (tick) only one response on each row*

	Follow appropriately	Do not follow appropriately	Don't know
Seed rate			
Fertilizer dosage			
Pesticides dosage			
Weedicides dosage			
Inter cultivation practices			
Weeding operations			
Land preparation operations			
Use of machinery/tools			
Harvesting practices			

**46. If you feel that there is a gap between what scientist/extension staff/department staff's suggestion and what farmers practice; what could be the extent of the gap (approximately)?**

*Please choose (tick) only one response from below list*

	Less than 10%
	Between 10% and 30%
	Between 30% and 60%
	Between 60% and 90%
	Don't feel there is a gap

<b>47. Do you think farmers' traditional knowledge is relevant in overcoming the following?</b> <i>Please choose (tick) only one response on each row</i>				
	Relevant to a great extent	Relevant to a limited extent	Don't know	Not Relevant
Problems of agriculture today				
Problems of environment today				
In increasing the yields				
At small and marginal farmers' level				
At socially backward farmers' level				

<b>48. Should yield be considered as the only parameter for the recommendation to farmers?</b> <i>Please choose (tick) only one response from below list (Single Choice)</i>	
<input type="checkbox"/>	Yes
<input type="checkbox"/>	I don't have any answer for this
<input type="checkbox"/>	No

<b>49. If yes, please rank the following options in order of agreement from 1 to 4.1 being the most agreeable and 4 being the least agreeable option. Please do not use the same rank for two options] Please choose (tick) only one response on each row and column (Rating Scale - Only one response per row and column)</b>				
	1	2	3	4
Yes, increasing the yields is the primary concern of agriculture science today				
Yes, increasing yields is necessary from the point of nation's food security				
Yes, increasing yields is necessary for farmers to gain from agriculture				
Yes, increasing yields is what primarily accounts for our Research				

<b>50. How did you come to know about farmers suicides in the country? Please choose (tick) one or more response from the list (Multiple Choice)</b>	
<input type="checkbox"/>	Not aware of them
<input type="checkbox"/>	Through media like newspapers/TV/Popular magazines
<input type="checkbox"/>	Through contact with farmers
<input type="checkbox"/>	Discussion with colleagues
<input type="checkbox"/>	Aware but not much interested
<input type="checkbox"/>	Government notification

**51. What kind of research projects have been given priority in funding in the last ten years?**  
*Mention one research area in each of the categories below. Please enter your response on each row below*

Very High priority	
High priority	
Low priority	
Very Low priority	

**52. How do you place the position of agricultural scientists among farmers today?**

*Please choose (tick) only one response on each row*

	Strongly Agree	Agree	Don't know	Disagree	Strongly Disagree
Farmers have stopped relying on agricultural scientists for suggestions					
Farmers are in need of information from scientists but scientists are not accessible					
Farmers' needs are met by agricultural department staff who carry the information provided by the agricultural scientists					
Farmers' needs are met by private market sources hence they don't depend on agricultural scientists					

**53. Do you think the work of agricultural scientist is relevant in overcoming the present agricultural situation which is not so favourable for the small and marginal farmers?**

*Please choose (tick) only one response from below list (Single Choice)*

<input type="checkbox"/>	Relevant to a great extent
<input type="checkbox"/>	Relevant to a limited extent
<input type="checkbox"/>	Farmers' needs are met by the agricultural department staff
<input type="checkbox"/>	Agricultural scientists are not bothered about the problems arising due to non-agricultural related issues
<input type="checkbox"/>	Can't say
<input type="checkbox"/>	Not relevant

**54. How do you rate the inputs you receive from social scientists in agricultural universities?**

*Please choose (tick) only one response on each row.*

	Strongly Agree	Agree	Don't know	Disagree	Strongly Disagree
My area of research doesn't need any inputs from social scientists					
My area of research needs inputs from social scientists but I find it difficult to get right information					
My area of research needs inputs from social scientists and I am highly satisfied about their inputs					

**55. How do you see the position of social sciences in agricultural universities?**

*Please choose (tick) only one response on each row*

	Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree
Social sciences are well grounded in agricultural universities					
Social sciences enrich agricultural research and education					
Social sciences are weakly placed in agricultural universities					
Social sciences do not offer a critical view of agricultural research					

**56. Do you agree with the statement that there is a need for close collaboration between agricultural sciences and social sciences?**

	Very Strongly
	Strongly
	Can't say
	Not necessary

\*\*\*Thank you for sparing your valuable time\*\*\*