A Study on Agriculture Scientists Rating on Acceptance and Rejection of Genitically Modified Organisms

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Abstract

People have manipulated foods and food crops for millennia, through methods ranging from fermentation to classical selection. Genetic engineering is just the latest form of biotechnology. Genetic engineering is fundamentally different from traditional methods of plant and animal breeding because it crosses biological barriers, transferring genes from one species to another. This paper deals with agriculture scientists rating on acceptance and rejection of genetically modified organisms. It outlines the various indicators of supporting genetically modified organisms and various indicators of rejecting genetically modified organisms. The indicators are quantified with the help of 5 point rating scale. This paper concludes with some interesting findings.

Introduction

The term GM foods or GMOs genetically-modified organisms is most commonly used to refer to crop plants created for human or animal consumption using the latest molecular biology techniques. These plants have been modified in the laboratory to enhance desired traits such as increased resistance to herbicides or improved nutritional content. Genetic engineering can create plants with the exact desired trait very rapidly and with great accuracy. For example, plant geneticists can isolate a gene responsible for drought tolerance and insert that gene into a different plant. The new genetically-modified plant will gain drought tolerance as well. Not only can genes be transferred from one plant to another, but genes from non-plant organisms also can be used. The best known example of this is the use of B.t. genes in corn and other crops. B.t., or Bacillus thuringiensis, is a naturally occurring bacterium that produces crystal proteins that are lethal to insect larvae. B.t. Crystal protein genes have been transferred into corn, enabling the corn to produce its own pesticides against insects.

Advantages of Gm Foods

Pest resistance: Farmers typically use many tons of chemical pesticides annually. Consumers do not wish to eat food that has been treated with pesticides because of potential health hazards, and run-off of agricultural wastes from excessive use of pesticides and fertilizers can poison the water supply and cause harm to the environment. Moellenbeck DJ, Peters ML, Bing JW, et al (2001) note that growing GM foods such as B.t. corn can help to eliminate the application of chemical pesticides and reduce the cost of bringing a crop to market.

Herbicide tolerance: Crop plants genetically-engineered to be resistant to one very powerful herbicide could help to prevent environmental damage by reducing the amount of herbicides needed. For example, Monsanto has created a strain of soybeans genetically modified to be not affected by their herbicide product Roundup. Salbego J, Pretto A, Gioda, C, et al (2010) have found that long-term exposition to environmental relevant concentrations of a Roundup formulation causes metabolic disruption in Leporinus obtusidens. A farmer grows these soybeans which then only require one application of weed-killer instead of multiple applications, reducing production cost and limiting the dangers of agricultural waste run-off.

Dahleen LS, Okubara PA, Blechl AE (2001) reported that there are many viruses, fungi and bacteria that cause plant diseases. Plant biologists are working to create plants with genetically-engineered resistance to these diseases.Kenward KD, Brandle J, Mc Pherson J, Davies PL (1999) reported from their studies that an antifreeze gene from cold water fish has been introduced into plants such as tobacco and potato. With this antifreeze gene, these plants are able to tolerate cold temperatures that normally would kill unmodified seedlings.

According to Zhang HX and Blumwald E (2001) as the world population grows and more land is utilized for housing instead of food production, farmers will need to grow crops in locations previously unsuited for plant cultivation. Creating plants that can withstand long periods of drought or high salt content in soil and groundwater will help people to grow crops in formerly inhospitable places.

Nutrition: Malnutrition is common in third world countries where impoverished peoples rely on a single crop such as rice for the main staple of their diet. However, rice does not contain adequate amounts of all necessary nutrients to prevent malnutrition. If rice could be genetically engineered to contain additional vitamins and minerals, nutrient deficiencies could be alleviated. For example, blindness due to vitamin A deficiency is a common problem in third world countries. Researchers at the Swiss Federal Institute of Technology Institute for Plant Sciences have created a strain of "golden" rice containing an unusually high content of beta-carotene (vitamin A).According to Paine JA, Shipton CA, Chaggar S, et al (2005)plants were underway to develop golden rice that also has increased iron content.Pharmaceuticals Medicines and vaccines often are costly to produce and sometimes require special storage conditions. Researchers are working to develop edible vaccines in tomatoes and potatoes Daniell H, Streatfield SJ, Wycoff K (2001). These vaccines will be much easier to ship, store and administer than traditional injectable vaccines.

Phytoremediation: Plants such as poplar trees have been genetically engineered to clean up heavy metal pollution from contaminated soil Ahmed M, Focht DD (2000).Another challenging phenomenon to face in our modern world is that of hybridization. It seems to have worked so very successfully in some commercial realms, and as a major application of Gregor Mendel's revolutionary Gene Theory. Mendel offered a logical extension of the larger mechanical worldview. There is growing evidence that the wholesale disappearance of bees relates directly to the appearance of ever more GM pollen. Farmers who view their land as their primary financial asset have reason to heed this warning. They need to be alarmed by evidence that genetically-modified soil bacteria contamination can arise. This is more than just possible, given the numerous (1600 or more) distinct microorganisms that can be found in a single teaspoon of soil. If that soil contamination remains permanently, the consequences can be catastrophic.

Lethal effects of Genetically Modified Food

"Recombinant DNA technology faces our society with problems unprecedented not only in the history of science, but of life on Earth. It places in human hands the capacity to redesign living organisms, the products of three billion years of evolution. Such intervention must not be confused with previous intrusions upon the natural order of living organisms: animal and plant breeding...All the earlier procedures worked within single or closely related species...Our morality up to now has been to go ahead without restriction to learn all that we can about nature. Restructuring nature was not part of the bargain...this direction may be not only unwise, but dangerous. Potentially, it could breed new animal and plant diseases, new sources of cancer, novel epidemics."

Recorded Deaths from GM: In 1989, dozens of Americans died and several thousands were afflicted and impaired by a genetically modified version of the food supplement L-tryptophan creating a debilitating ailment known as Eosinophilia myalgia syndrome (EMS). Released without safety tests, there were 37 deaths reported and approximately 1500 more were disabled. A settlement of $2 billion dollars was paid by the manufacturer, Showa Denko, Japan's third largest chemical company destroyed evidence preventing a further investigation and made a 2 billion dollar settlement. Since the very first commercially sold GM product was lab tested (Flavr Savr) animals used in such tests have prematurely died.

Near-deaths and Food Allergy Reactions: In 1996, Brazil nut genes were spliced into soybeans to provide the added protein methionine and by a company called Pioneer Hi-Bred. Some individuals, however, are so allergic to this nut; they can go into anaphylactic shock similar to a severe bee sting reaction which can cause death. Using genetic engineering, the allergens from one food can thus be transferred to another, thought to be safe to eat, and unknowingly. Animal and human tests confirmed the peril and fortunately the product was removed from the market before any fatalities occurred. The animal tests conducted, however, were insufficient by themselves to show this. Had they alone been relied upon, a disaster would have followed.Corn- Two research studies independently show evidence of allergenic reactions to GM Bt corn, Farm workers exposed to genetically-modified Bt sprays exhibited extensive allergic reactions.Potatoes - A study showed genetically-modified potatoes expressing cod genes were

allergenic.Peas - A decade-long study of GM peas was abandoned when it was discovered that they caused allergic lung damage in mice. Soy - In March 1999, researchers at the York Laboratory discovered that reactions to soy had skyrocketed by 50% over the year before, which corresponded with the introduction of genetically-modified soy from the US. It was the first time in 17 years that soy was tested in the lab among the top ten allergenic foods.

Cancer and Degenerative Diseases

Direct Cancer and Degenerative Disease: GH is a protein hormone which, when injected into cows stimulates the pituitary gland in a way that the produces more milk, thus making milk production more profitable for the large dairy corporations. In 1993, food and drug administration (FDA) approved Monsanto's genetically-modified rBGH, a genetically-altered growth hormone that could be then injected into dairy cows to enhance this feature, and even though scientists warned that this resulted in an increase of IGF-1 (from (70%-1000%). Canadian studies confirmed such a suspicion and showed active IGF-1 absorption, thyroid cysts and internal organ damage in rats. Yet the food and drug administration denied the significance of these findings. When two award-winning journalists, Steve Wilson and Jane Akre, tried to expose these deceptions, they were fired by Fox Network under intense pressure from Monsanto.

As to other degenerative disease, according to a study by researcher Dr. Sharyn Martin, a number of autoimmune diseases are enhanced by foreign DNA fragments that are not fully digested in the human stomach and intestines. DNA fragments are absorbed into the bloodstream, potentially mixing with normal DNA. The genetic consequences are unpredictable and unexpected gene fragments have shown up in GM soy crops. A similar view is echoed by Dr. Joe Cummins, Professor of Genetics at the University of Western Ontario, noting that animal experiments have demonstrated how exposure to such genetic elements may lead to inflammation, arthritis and lymphoma.

Indirect, Non-traceable Effects on Cancer Rates: The twentieth century saw an incremental lowering of infectious disease rates, especially where a single bacteria was overcome by an antibiotic, but a simultaneous rise in systemic, whole body or immune system breakdowns. The epidemic of cancer is a major example and is affected by the overall polluted state of our environment, including in the pollution of the air, water, and food we take in.Cows injected with rBGH have a much higher level of udder infections. The Center for Food Safety claims a 25% increase in the frequency of udder infections in cows that are given this growth hormone. Since this hormone causes infections, farmers will use more antibiotics that may eventually end up in the dairy products we consume.

Much of the techniques of genetic implantation are ineffective so scientists must use a marker to track where the gene goes into the plant cell. It could be noted that GM maize plants use an ampicillin resistant gene. In 1998, the British Royal Society called for the banning of this marker as it threatens a vital antibiotic's use. Halloran and Hansen elaborate on this saying that some European countries have prohibited the growth of certain genetically engineered corn due to the fact that the gene can be transferred to the food chain. The resistant qualities of GM bacteria in food can be transferred to other bacteria in the environment and throughout the human body causing society to be less receptive to common antibiotics.

There is growing resistance to antibiotics misused in bioengineering, the formation of new and unknown viral strains, and the lowering of immunity through diets of processed and altered foods. There is also the horizontal transfer of transgenic DNA among bacteria. Several studies have shown bacteria of the mouth, pharynx and intestines can take up the transgenic DNA in the feed of animals, which in turn can be passed on to humans. This threatens the hallmark accomplishment of the twentieth century the reduction in infectious diseases that critically helped the doubling of life expectancy.

Genetic Pollution

Carrying GM pollen by wind, rain, birds, bees, insects, fungus, bacteria the entire chain of life becomes involved. Once released, unlike chemical pollution, there is no cleanup or recall possible. As mentioned, pollen from a single GM tree has been shown to travel 1/5th of the length of the United States. Thus there is no containing such genetic pollution. Experiments in Germany have shown that engineered oilseed rape can have its pollen move over 200 meters. As a result German farmers have sued to stop field trials in Berlin. In Thailand, the government stopped

field tests for Monsanto's Bt cotton when it was discovered by the Institute of Traditional Thai Medicine that 16 nearby plants of the cotton family, used by traditional healers, were being genetically polluted.

Methods and Materials

This paper deals with agriculture scientists rating on acceptance and rejection of genetically modified organisms. In this study agriculture scientists are selected from the Tamil Nadu, representing Agriculture University, agriculture colleges, agriculture research institutions and government agriculture department. From each group 50 agriculture scientists are selected as sample under simple random sampling method. In this study indicators rating to acceptance of genetically modified organisms and rejection of genetically modified organisms are identified. The data from the respondents are collected with the help of well structured questionnaire method. The collected qualitative data are quantified with help of 5 point rating scale in the order of very high level indicates the 5 point rating score, high level 4 point rating score, moderate level 3 point rating score, low level 2 point rating score and very low level 1 point rating score. The collected data are classified and tabulated with the help of computer programming. The data analysis is done with the help of average analysis, ANOVA two way analysis and t test.

Acceptance Level of Genetically modified organisms

This section deals with respondents' rating on acceptance level of genetically modified organisms. It can be assessed with the help of 19 factors on a 5 point rating scale. These include ornamental garden plants with new properties, animals reared as donors for Gm organ transplants, GM plants for plant made pharmaceuticals, GM plants for human food with improved quality characteristics of fruits, micro organisms with the ability to synthesize applicable organic acid, gm trees designed for industrial and energy purpose, production of milk producing animals that milk containing medical substances, crop plants with increased tolerance to salinity and drought condition, micro organisms that can degrade toxic substances previously biologically non degradable, cultivation of GM plants on a small scale for some specific crops, GM plants for phytoremediation, plants used for producing biofuels, Genetically modified viruses designed for the transfer of genes between organisms, ornamental house plants with new properties, animal for food consumption having meat with improved characteristics, plants for animal food resistance to pests and pathogens, domestic animals with new properties, micro organisms with the ability to synthesize medical substances like insulin and plants for human food resistant to pests and pathogens.

Table1 Agriculture Scientist Wise Respondents' Rating on Acceptance Level of Genetically modified organisms

Variables	Universities	Colleges	Research Institutions	Government Department	Mean
Domestic animals with new properties	2.09	1.91	2.35	2.53	2.22
Genetically modified viruses designed for the transfer of genes between organisms	2.55	2.37	2.81	2.99	2.68
Crop plants with increased tolerance to salinity and drought condition	3.02	2.84	3.28	3.46	3.15
Micro organisms that can degrade toxic substances previously biologically non degradable	2.90	2.72	3.16	3.34	3.03
Micro organisms with the ability to synthesize medical substances like insulin	2.10	1.92	2.11	2.19	2.08
Micro organisms with the ability to synthesize applicable organic acid	3.37	3.19	3.63	3.81	3.50
Ornamental house plants with new properties	2.44	2.26	2.70	2.88	2.57
Ornamental garden plants with new properties	3.97	3.79	4.23	4.41	4.10
Plants used for producing biofuels	2.64	2.46	2.90	3.08	2.77
Plants for human food with improved quality characteristics of fruits	3.45	3.27	3.71	3.89	3.58
Plants for human food resistant to pests and pathogens	1.82	1.80	2.02	2.16	1.95
Plants for animal food resistance to pests and pathogens	2.27	2.09	2.53	2.71	2.40
Production of milk producing animals that milk containing medical substances	3.14	2.96	3.40	3.58	3.27

Animals reared as donors for gm organ transplants	3.77	3.59	4.07	4.17	3.90
Animal for food consumption having meat with improved characteristics	2.36	2.18	2.62	2.80	2.49
GM plants for phytoremediation	2.72	2.54	2.98	3.16	2.85
GM trees designed for industrial and energy purpose	3.26	3.08	3.52	3.70	3.39
GM plants for plant made pharmaceuticals	3.54	3.36	3.80	3.98	3.67
Cultivation of GM plants on a small scale for some specific crops	2.81	2.63	3.07	3.25	2.94
Average	2.85	2.68	3.10	3.27	2.98

Source: Computed from the primary data

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*F crit*
Variation due to GMO acceptance level	27.34505	18	1.51917	659.8933	1.798236
Variation due to institutions	3.833884	3	1.277961	555.1179	2.775762
Error	0.124316	54	0.002302		
Total	31.30325	75			

Data presented in table 1 indicate the agriculture scientist wise respondents' rating on acceptance levels of genetically modified organisms. It could be noted that out of the 19 acceptance levels of genetically modified organism, the respondents rate the ornamental garden plants with new properties as their first level acceptance of genetically modified organism and it is evident from their secured a mean score of 4.10 on a 5 point rating scale. Animals reared as donors for GM organ transplants is rated at second level acceptance towards genetically modified organisms and it is estimated from the respondents' secured a mean score of 3.90 on a 5 point rating scale. The respondents have desire to acceptgenetically modified organismin the form of GM plants for plant made pharmaceuticals as their third level acceptance. It is evident from their secured a mean score of 3.67 on a 5 point rating scale. The respondents rank the fourth level acceptance towards genetically modified organism by the way of producing plants for human food with improved quality characteristics of fruits and it is observed from the respondents' secured a mean score of 3.58 on a 5 point rating scale. Micro organisms with the ability to synthesize applicable organic acid is rated at fifth level acceptance towards genetically modified organism and it could be known from the respondents' secured a mean score of 3.50 on a 5 point rating scale.

The respondents rate the GM trees designed for industrial and energy purpose as their rated sixth level desire to accept thegenetically modified organism and it is revealed from their secured a mean score of 3.39 on a 5 point rating scale. Production of milk producing animals that milk containing medical substances is rated at seventh level desired form ofgenetically modified organism and it observed from the respondents' secured a mean score of 3.27 on a 5 point rating scale. The respondents wish to accept thegenetically modified organismin the form of crop plants with increased tolerance to salinity and drought condition and it is their eighth level ranking. It is evident from their secured a mean score of 3.15 on a 5 point rating scale. The respondents rank the ninth level acceptance towards genetically modified organism by citing the needs to develop micro organism that can degrade toxic substances previously biologically non degradable as per their secured a mean score of 3.03 on a 5 point rating scale.Cultivation of GM plants on a small scale for some specific crops is rated at tenth level acceptance towards genetically modified organism and it is evident from the respondents' secured a mean score of 2.94 on a 5 point rating scale.

The respondents rate the GM plants for phytoremediation as their eleventh level acceptance towards genetically modified organism and it could be known from their secured a mean score of 2.85 on a 5 point rating scale. Plants used for producing biofuels is rated at twelfth level desire to accept thegenetically modified organism and it is reflected from the respondents' secured a mean score of 2.77 on a 5 point rating scale. The respondents rank the thirteenth level acceptance towards genetically modified organismby the way of developing genetically modified viruses designed for the transfer of genes between organisms. It is evident from their secured a mean score of 2.68 on a 5 point rating scale. The respondents rank the fourteenth level acceptance towards genetically modified

organismin the form of developingornamental house plants with new propertiesand it is clear from their secured a mean score of 2.57 on a 5 point rating scale. Animal for food consumption having meat with improved characteristics is rated at fifteenth level acceptance ongenetically modified organism as per the respondents' secured a mean score of 2.49 on a 5 point rating scale.

The respondents rate the plants for animal food resistance to pests and pathogens as their sixteenth level acceptance ongenetically modified organism and it is revealed from their secured a mean score of 2.40 on a 5 point rating scale. Domestic animals with new properties is rated at seventeenth level acceptance ongenetically modified organism and it is revealed from the respondents' secured a mean score of 2.22 on a 5 point rating scale. The respondents haveacceptance ongenetically modified organisms by the way of developingmicro organisms with the ability to synthesize medical substances like insulin and it is evident from their eighteenth level ranking ongenetically modified organisms. It is known from their secured a mean score of 2.08 on a 5 point rating scale. The respondents rank the nineteenth level acceptance ongenetically modified organismin the form ofdevelopingplants for human food resistant to pests and pathogens as per their secured a mean score of 1.95 on a 5 point rating scale.

The government department agriculture scientist respondents' rank the first positions in their overall rated acceptance ongenetically modified organismas per their secured a mean score of 3.27 on a 5 point rating scale. The research institutions agriculture scientist respondents' record the second position in their overall rated desire to accept thegenetically modified organismand it is known from their secured a mean score of 3.10 on a 5 point rating scale. The University agriculture scientist respondents' register the third position in their overall rated willingness to accept thegenetically modified organism and it is computed from their secured a mean score of 2.85 on a 5 point rating scale. The college agriculture scientist respondents' come down to the last position in their overall rated desire to accept thegenetically modified organismand it is estimated from their secured a mean score of 2.68 on a 5 point rating scale.

The anova two way model is applied for further discussion. The computed anova value 659.89 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the overall rated acceptance ongenetically modified organisms is statistically identified as significant. In another point, the computed anova value 555.11 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the agriculture scientists is statistically identified as significant as per the respondents rating on acceptance level ongenetically modified organisms.

Table 2 Education Wise Respondents' Rating on Acceptance Level of Genetically modified organisms

Variables	Doctorate degree	M.Phil degree	Masters' degree	Under graduate degree	Mean
Domestic animals with new properties	2.47	2.28	2.16	1.97	2.22
Genetically modified viruses designed for the transfer of genes between organisms	2.93	2.74	2.62	2.43	2.68
Crop plants with increased tolerance to salinity and drought condition	3.40	3.21	3.09	2.90	3.15
Micro organisms that can degrade toxic substances previously biologically non degradable	3.28	3.09	2.97	2.78	3.03
Micro organisms with the ability to synthesize medical substances like insulin	2.23	2.14	2.02	1.93	2.08
Micro organisms with the ability to synthesize applicable organic acid	3.75	3.56	3.44	3.25	3.50
Ornamental house plants with new properties	2.82	2.63	2.51	2.32	2.57
Ornamental garden plants with new properties	4.20	4.16	4.10	3.95	4.10
Plants used for producing biofuels	3.02	2.83	2.71	2.52	2.77

Plants for human food with improved quality characteristics of fruits	3.83	3.64	3.52	3.33	3.58
Plants for human food resistant to pests and pathogens	2.10	2.01	1.89	1.80	1.95
Plants for animal food resistance to pests and pathogens	2.65	2.46	2.34	2.15	2.40
Production of milk producing animals that milk containing medical substances	3.52	3.33	3.21	3.02	3.27
Animals reared as donors for gm organ transplants	4.15	3.96	3.84	3.65	3.90
Animal for food consumption having meat with improved characteristics	2.74	2.55	2.43	2.24	2.49
GM plants for phytoremediation	3.10	2.91	2.79	2.60	2.85
GM trees designed for industrial and energy purpose	3.64	3.45	3.33	3.14	3.39
GM plants for plant made pharmaceuticals	3.92	3.73	3.61	3.42	3.67
Cultivation of GM plants on a small scale for some specific crops	3.19	3.00	2.88	2.69	2.94
Average	3.21	3.04	2.92	2.74	2.98

Source: Computed from the primary data

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*F crit*
Variation due to GMO acceptance level	27.36756	18	1.52042	1268.923	1.798236
Variation due to education	2.190972	3	0.730324	609.5193	2.775762
Error	0.064703	54	0.001198		
Total	29.62324	75			

Table 2 presents data on the education wise respondents' rating on acceptances towards genetically modified organisms. The doctorate degree level educated respondents rank the first position in their overall rated acceptance ongenetically modified organisms and it is evident from their secured a mean score of 3.21 on a 5 point rating scale. The M.Phil degree level educated respondents record the second position in their overall ranked desire to accept thegenetically modified organisms and it is revealed from their secured a mean score of 3.04 on a 5 point rating scale. The Master degree level educated respondents register the third position in their overall ranked willingness to accept the genetically modified organisms and it is reflected from their secured a mean score of 2.92 on a 5 point rating scale. The under graduate degree level educated respondents come down to the last position in their overall rated desire to accept thegenetically modified organisms and it is estimated from their secured a mean score of 2.74 on a 5 point rating scale.

The anova two way model is applied for further discussion. The computed anova value 1268.92 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the overall rated acceptance ongenetically modified organisms is statistically identified as significant. In another point, the computed anova value 609.51 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the educational groups is statistically identified as significant as per the respondents rating on acceptancesongenetically modified organisms.

Table 3 Caste Wise Respondents' Rating on Acceptance Level of Genetically modified organisms

Variables	Forward caste	Backward caste	Most backward caste	Scheduled caste	Mean
Domestic animals with new properties	2.52	2.31	2.13	1.92	2.22
Genetically modified viruses designed for the transfer of	3.18	2.97	2.39	2.18	2.68

genes between organisms					
Crop plants with increased tolerance to salinity and drought condition	3.95	3.44	2.86	2.35	3.15
Micro organisms that can degrade toxic substances previously biologically non degradable	3.83	3.32	2.74	2.23	3.03
Micro organisms with the ability to synthesize medical substances like insulin	2.25	2.11	1.99	1.87	2.08
Micro organisms with the ability to synthesize applicable organic acid	4.15	3.79	3.21	2.85	3.50
Ornamental house plants with new properties	3.37	2.86	2.28	1.77	2.57
Ornamental garden plants with new properties	4.20	4.17	4.08	3.95	4.10
Plants used for producing biofuels	3.37	3.06	2.48	2.17	2.77
Plants for human food with improved quality characteristics of fruits	4.18	3.87	3.29	2.98	3.58
Plants for human food resistant to pests and pathogens	2.15	2.05	1.86	1.80	1.95
Plants for animal food resistance to pests and pathogens	2.80	2.59	2.21	2.00	2.40
Production of milk producing animals that milk containing medical substances	4.07	3.56	2.98	2.47	3.27
Animals reared as donors for gm organ transplants	4.20	4.10	3.70	3.60	3.90
Animal for food consumption having meat with improved characteristics	3.04	2.52	2.25	2.15	2.49
GM plants for phytoremediation	3.65	3.14	2.56	2.05	2.85
GM trees designed for industrial and energy purpose	4.19	3.68	3.10	2.59	3.39
GM plants for plant made pharmaceuticals	4.17	3.96	3.38	3.17	3.67
Cultivation of GM plants on a small scale for some specific crops	3.74	3.23	2.65	2.14	2.94
Average	3.53	3.20	2.74	2.43	2.98

Source: Computed from the primary data

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*F crit*
Variation due to GMO acceptance level	27.40449	18	1.522472	33.02724	1.798236
Variation due to caste groups	13.29614	3	4.432046	96.1451	2.775762
Error	2.489263	54	0.046097		
Total	43.18989	75			

Table 3 presents data on the caste wise respondents' desire to accept thegenetically modified organisms. The forward caste respondents rank the first position in their overall revealed desire to accept genetically modified organisms and it is evident from their secured a mean score of 3.53 on a 5 point rating scale. The backward caste respondents' record the second position in their overall rated possibilities to accept thegenetically modified organisms and it is learnt from their secured a mean score of 3.20 on a 5 point rating scale. The most backward caste respondents register the third position in their overall reflected willingness to accept genetically modified organisms and it is revealed from their secured a mean score of 2.74 on a 5 point rating scale. The schedule caste respondents come down to the last position in their overall rated acceptanceongenetically modified organisms as per their secured a mean score of 2.43 on a 5 point rating scale.

The anova two ways model is applied for further discussion. The computed anova value 33.02 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the overall acceptance ongenetically modified organisms is statistically identified as significant. In another point, the computed anova value 96.14 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the caste groups is statistically identified as significant as per the respondents rating on acceptancesongenetically modified organisms.

Table 4 Sex Wise Respondents' Rating on Acceptance Level of Genetically modified organisms

Variables	Male	Female	Mean
Domestic animals with new properties	2.32	2.12	2.22
Genetically modified viruses designed for the transfer of genes between organisms	2.90	2.46	2.68
Crop plants with increased tolerance to salinity and drought condition	3.37	2.93	3.15
Micro organisms that can degrade toxic substances previously biologically non degradable	3.25	2.81	3.03
Micro organisms with the ability to synthesize medical substances like insulin	2.30	1.86	2.08
Micro organisms with the ability to synthesizeapplicable organic acid	3.72	3.28	3.50
Ornamental house plants with new properties	2.79	2.35	2.57
Ornamental garden plants with new properties	4.12	4.08	4.10
Plants used for producing biofuels	2.99	2.55	2.77
Plants for human food with improved quality characteristics of fruits	3.80	3.36	3.58
Plants for human food resistant to pests and pathogens	2.02	1.88	1.95
Plants for animal food resistance to pests and pathogens	2.62	2.18	2.40
Production of milk producing animals that milk containing medical substances	3.49	3.05	3.27
Animals reared as donors for gm organ transplants	4.12	3.68	3.90
Animal for food consumption having meat with improved characteristics	2.71	2.27	2.49
GM plants for phytoremediation	3.07	2.63	2.85
GM trees designed for industrial and energy purpose	3.61	3.17	3.39
GM plants for plant made pharmaceuticals	3.89	3.45	3.67
Cultivation of GM plants on a small scale for some specific crops	3.16	2.72	2.94
Average	3.17	2.78	2.98

Source: Computed from the primary data

T Statistical Value 14.13, df 18, T Critical Value 1.73

Data presented in table 4 indicate the sex wise respondents' rating on acceptances towards genetically modified organisms. The male respondents' ranks the first position in their overall rated acceptancesongenetically modified organisms as per their secured a mean score of 3.17 on a 5 point rating scale. The female respondents hold the second position in their overall rated acceptancesongenetically modified organisms as per their secured a mean score of 2.78 on a 5 point rating scale.

The T test is applied for further discussion. The computed t value 14.13 is greater than its tabulated value at 5 per cent level significance. Hence there is a significant difference between male respondents and female respondents in their overall ratedacceptancesongenetically modified organisms.

Table 5 Area Wise Respondents' Rating on Acceptance Level of Genetically modified organisms

Variables	Rural	Urban	Mean
Domestic animals with new properties	2.06	2.38	2.22
Genetically modified viruses designed for the transfer of genes between organisms	2.42	2.94	2.68
Crop plants with increased tolerance to salinity and drought condition	2.99	3.31	3.15
Micro organisms that can degrade toxic substances previously biologically non degradable	2.67	3.39	3.03
Micro organisms with the ability to synthesize medical substances like insulin	2.02	2.17	2.08
Micro organisms with the ability to synthesizeapplicable organic acid	3.14	3.86	3.50
Ornamental house plants with new properties	2.31	2.83	2.57
Ornamental garden plants with new properties	4.04	4.16	4.10
Plants used for producing biofuels	2.51	3.03	2.77
Plants for human food with improved quality characteristics of fruits	3.22	3.94	3.58
Plants for human food resistant to pests and pathogens	1.89	2.01	1.95
Plants for animal food resistance to pests and pathogens	2.24	2.56	2.40
Production of milk producing animals that milk containing medical substances	3.13	3.43	3.27
Animals reared as donors for gm organ transplants	3.72	4.10	3.90
Animal for food consumption having meat with improved characteristics	2.23	2.75	2.49

GM plants for phytoremediation	2.69	3.01	2.85
GM trees designed for industrial and energy purpose	3.03	3.75	3.39
GM plants for plant made pharmaceuticals	3.31	4.03	3.67
Cultivation of GM plants on a small scale for some specific crops	2.58	3.30	2.94
Average	2.75	3.21	2.98

Source: Computed from the primary data

T Statistical Value 9.19, df 18, T Critical Value 1.73

Data presented in table 5 indicate the area wise respondents' rating on acceptances towards genetically modified organisms. The urban respondents' ranks the first position in their overall rated desire to accept thegenetically modified organisms as per their secured a mean score of 3.21 on a 5 point rating scale. The rural respondents hold the second position in their overall rated willingness to accept thegenetically modified organisms as per their secured a mean score of 2.75 on a 5 point rating scale.

The T test is applied for further discussion. The computed t value 9.19 is greater than its tabulated value at 5 per cent level significance. Hence there is a significant difference between urban respondents and rural respondents in their overall ratedacceptance ongenetically modified organisms.

Rejection of Genetically Modified Crop Cultivation

This section deals with respondents' rating on rejection of genetically modified crop cultivation. It can be assessed with the help of 21 factors on a 5 point rating scale. These include transfer of protein from one plant to another, creating superweeds that have evolved a resistance to glyphosate, bacterial toxin develops BT resistant crops, gene migration among species, degradation of biodiversity, disturbance to natural food chain, destruction of honey bees and other natural pollinators, GMOs crops pollinate and their seeds can travel, GM crops increased the herbicide use, GM plant can result in massive collateral damage that produces new toxins, GM crops do not increase yields work against feeding a hungry world, herbicides used of GM plants can harm birds, insects, amphibians and other soil organisms, damaging agro ecosystem, disturbance to natural pollination process, threats to organic farming, genes can end up in unexpected plants, loss of farmers' access to plant materials, terminator technology, genes can mutate with harmful effects, destruction of indigenous farming knowledge and promotion of corporate agriculture.

Table 6 Agriculture Scientist Wise Respondents' Rating on Rejection of Genetically Modified Crop Cultivation

Variables	Universities	Colleges	Research Institutions	Government Department	Mean
Transfer of protein from one plant to another	2.37	2.15	2.75	2.97	2.56
Creating superweeds that have evolved a resistance to glyphosate	3.10	2.88	3.48	3.70	3.29
Bacterial toxin develops BT resistant crops	2.65	2.43	3.03	3.25	2.84
Gene migration among species	3.48	3.26	3.86	4.08	3.67
Degradation of biodiversity	2.12	1.90	2.50	2.72	2.31
Disturbance to natural food chain	3.60	3.38	3.98	4.20	3.79
Destruction of honey bees and other natural pollinators	2.99	2.77	3.37	3.59	3.18
GMOs crops pollinate and their seeds can travel	2.21	1.99	2.59	2.81	2.40
GM crops increased the herbicide use	3.93	3.71	4.21	4.23	4.02
GM plant can result in massive collateral damage that produces new toxins	3.18	2.96	3.56	3.78	3.37
GM crops do not increase yields work against feeding a hungry world	1.86	1.74	2.00	2.10	1.95
Herbicides used of GM plants can harm birds, insects, amphibians and other soil organisms	2.44	2.22	2.82	3.04	2.63

Damaging agro ecosystem	2.76	2.54	3.14	3.36	2.95
Disturbance to natural pollination process	3.87	3.65	4.15	4.17	3.96
Threats to organic farming	1.98	1.76	2.36	2.58	2.17
Genes can end up in unexpected plants	2.30	2.08	2.68	2.90	2.49
Loss of farmers' access to plant materials	3.37	3.15	3.75	3.97	3.56
Terminator technology	3.69	3.57	4.07	4.19	3.88
Genes can mutate with harmful effects	2.52	2.30	2.90	3.12	2.71
Destruction of indigenous farming knowledge	4.06	3.94	4.19	4.21	4.10
Promotion of corporate agriculture	2.88	2.66	3.26	3.48	3.07
Average	2.92	2.72	3.27	3.45	3.09

Source: Computed from the primary data

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*F crit*
Rows	35.22926	20	1.761463	287.8655	1.747984
Columns	6.922557	3	2.307519	377.1043	2.758078
Error	0.367143	60	0.006119		
Total	42.51896	83			

Data presented in table 6 indicate the agriculture scientist rating on rejection of genetically modified crop cultivation. It could be noted that out of the 21 factors rejections of genetically modified crop cultivation, the respondents rate the destruction of indigenous farming knowledge as their first level rejection of genetically modified crop cultivation and it is evident from their secured a mean score of 4.10 on a 5 point rating scale. GM crops increased the herbicide use is rated at second level rejection of genetically modified crop cultivation and it is estimated from the respondents' secured a mean score of 4.02 on a 5 point rating scale. The respondents rate thedisturbance to natural pollination process as their third level rejection of genetically modified crop cultivation. It is evident from their secured a mean score of 3.96 on a 5 point rating scale. The respondents rank the fourth level rejection of genetically modified crop cultivationas it belongs to theterminator technology and it is observed from the respondents' secured a mean score of 3.88 on a 5 point rating scale. Disturbance to natural food chain is rated at fifth level rejection of genetically modified crop cultivation and it could be known from the respondents' secured a mean score of 3.79 on a 5 point rating scale.

The respondents rate the gene migration among species as their rated sixth level rejection of genetically modified crop cultivation and it is revealed from their secured a mean score of 3.67 on a 5 point rating scale. Loss of farmers' access to plant materials is rated at seventh level rejection of genetically modified crop cultivation and it observed from the respondents' secured a mean score of 3.56 on a 5 point rating scale. The respondents wish to rejection of genetically modified crop cultivationby citing the fact thatcrop plants with GM plant can result in massive collateral damage that produces new toxins and it is their eighth level ranking. It is evident from their secured a mean score of 3.37 on a 5 point rating scale. The respondents rank the ninth level rejection of genetically modified crop cultivation by citing fact ofcreating superweeds that have evolved a resistance to glyphosate as per their secured a mean score of 3.29 on a 5 point rating scale.Destruction of honey bees and other natural pollinators is rated at tenth level rejection of genetically modified crop cultivation and it is evident from the respondents' secured a mean score of 3.18 on a 5 point rating scale.

The respondents rate the promotion of corporate agriculture as their eleventh level rejection of genetically modified crop cultivation and it could be known from their secured a mean score of 3.07 on a 5 point rating scale. Damaging agro ecosystem is rated at twelfth level rating on rejection of genetically modified crop cultivation and it is reflected from the respondents' secured a mean score of 2.95 on a 5 point rating scale. The respondents rank the thirteenth level r4ejectiobn of cultivation of genetically modified crops by the way of citing the fact that bacterial toxin develops BT resistant crops. It is evident from their secured a mean score of 2.84 on a 5 point rating scale. The respondents rank the fourteenth level rejection of genetically modified crop cultivationconsequent upongenes can mutate with harmful effects and it is clear from their secured a mean score of 2.71 on a 5 point rating scale.

Herbicides used for GM plants can harm birds, insects, amphibians and other soil organisms is rated at fifteenth level rejection of genetically modified crop cultivation as per the respondents' secured a mean score of 2.63 on a 5 point rating scale.

The respondents rate the transfer of protein from one plant to another as their sixteenth level rejection of genetically modified crop cultivation and it is revealed from their secured a mean score of 2.56 on a 5 point rating scale. Genes can end up in unexpected plantsis rated at seventeenth level rejection of genetically modified crop cultivation and it is revealed from the respondents' secured a mean score of 2.49 on a 5 point rating scale. The respondents have rejection of genetically modified crop cultivation by citing the fact thatGMOs crops pollinate and their seeds can travel and it is evident from their eighteenth level ranking on rejection of genetically modified crop cultivation. It is known from their secured a mean score of 2.40 on a 5 point rating scale. The respondents rank the nineteenth level rejection of genetically modified crop cultivationby the way ofdegradation of biodiversity as per their secured a mean score of 2.31 on a 5 point rating scale. Threats to organic farming are rated at twentieth level rejection of genetically modified crop cultivation as per the respondents' secured a mean score of 2.17 on a 5 point rating scale.The respondents' rate the GM crops do not increase yields work against feeding a hungry world as their twenty first level rejection of genetically modified crop cultivation and it is revealed from their secured a mean score of 1.95 on a 5 point rating scale.

The government department agriculture scientistsrank the first positions in their overall rated rejection of genetically modified crop cultivationas per their secured a mean score of 3.45 on a 5 point rating scale. The research institutions agriculture scientist record the second position in their overall rated rejection of genetically modified crop cultivationand it is known from their secured a mean score of 3.27 on a 5 point rating scale. The University agriculture scientist register the third position in their overall rated rejection of genetically modified crop cultivation and it is computed from their secured a mean score of 2.92 on a 5 point rating scale. The college agriculture scientist come down to the last position in their overall rated rejection of genetically modified crop cultivationand it is estimated from their secured a mean score of 2.72 on a 5 point rating scale.

The anova two way model is applied for further discussion. The computed anova value 287.86 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the overall rated rejections of genetically modified crop cultivation is statistically identified as significant. In another point, the computed anova value 377.10 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the agriculture scientists is statistically identified as significant as per the respondents rating on rejection of genetically modified crop cultivation.

Table 7 Education Wise Respondents' Rating on Rejection of Genetically Modified Crop Cultivation

Variables	Doctorate degree	M.Phil degree	Masters' degree	Under graduate degree	Mean
Transfer of protein from one plant to another	2.87	2.64	2.53	2.25	2.56
Creating superweeds that have evolved a resistance to glyphosate	3.60	3.37	3.26	2.20	3.29
Bacterial toxin develops BT resistant crops	3.15	2.92	2.81	2.93	2.84
Gene migration among species	3.98	3.75	3.64	2.48	3.67
Degradation of biodiversity	2.52	2.39	2.28	3.31	2.31
Disturbance to natural food chain	4.10	3.87	3.76	2.05	3.79
Destruction of honey bees and other natural pollinators	3.49	3.26	3.15	3.43	3.18
GMOs crops pollinate and their seeds can travel	2.71	2.48	2.37	2.82	2.40
GM crops increased the herbicide use	4.13	4.10	3.99	2.04	4.02
GM plant can result in massive collateral damage that produces new toxins	3.68	3.45	3.34	3.86	3.37
GM crops do not increase yields work against feeding a hungry	2.06	2.03	1.92	3.01	1.95

world					
Herbicides used of GM plants can harm birds, insects, amphibians and other soil organisms	2.94	2.71	2.60	1.79	2.63
Damaging agro ecosystem	3.26	3.03	2.92	2.27	2.95
Disturbance to natural pollination process	4.07	4.04	3.93	2.59	3.96
Threats to organic farming	2.38	2.15	2.14	3.80	2.17
Genes can end up in unexpected plants	2.70	2.57	2.46	2.01	2.49
Loss of farmers' access to plant materials	3.87	3.64	3.53	2.23	3.56
Terminator technology	4.09	4.06	3.85	3.20	3.88
Genes can mutate with harmful effects	3.02	2.79	2.68	3.52	2.71
Destruction of indigenous farming knowledge	4.11	4.12	4.17	2.35	4.10
Promotion of corporate agriculture	3.38	3.15	3.04	4.00	3.07
Average	3.34	3.17	3.07	2.77	3.09

Source: Computed from the primary data

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*F crit*
Rows	18.4316	20	0.92158	3.211599	1.747984
Columns	3.604481	3	1.201494	4.187065	2.758078
Error	17.21722	60	0.286954		
Total	39.2533	83			

Table 7 presents data on the education wise respondents' rating on rejections of genetically modified crop cultivation. The doctorate degree level educated respondents rank the first position in their overall rated rejections of genetically modified crop cultivation and it is evident from their secured a mean score of 3.34 on a 5 point rating scale. The M.Phil degree level educated respondents record the second position in their overall ranked rejections of genetically modified crop cultivation and it is revealed from their secured a mean score of 3.17 on a 5 point rating scale. The Master degree level educated respondents register the third position in their overall ranked rejections of genetically modified crop cultivation and it is reflected from their secured a mean score of 3.07 on a 5 point rating scale. The under graduate degree level educated respondents come down to the last position in their overall rated rejections of genetically modified crop cultivation and it is estimated from their secured a mean score of 2.77 on a 5 point rating scale.

The anova two way model is applied for further discussion. The computed anova value 3.21 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the overall rated rejections of genetically modified crop cultivation is statistically identified as significant. In another point, the computed anova value 4.185 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the educational groups is statistically identified as significant as per the respondents rating on rejections of genetically modified crop cultivation.

Table 8 Caste Wise Respondents' Rating on Rejection of Genetically Modified Crop Cultivation

Variables	Forward caste	Backward caste	Most backward caste	Scheduled caste	Mean
Transfer of protein from one plant to another	2.95	2.67	2.45	2.17	2.56
Creating superweeds that have evolved a resistance to glyphosate	3.68	3.40	3.18	2.90	3.29
Bacterial toxin develops BT resistant crops	3.23	2.95	2.73	2.45	2.84

Gene migration among species	4.06	3.78	3.56	3.28	3.67
Degradation of biodiversity	2.60	2.42	2.20	2.02	2.31
Disturbance to natural food chain	4.18	3.90	3.68	3.40	3.79
Destruction of honey bees and other natural pollinators	3.57	3.29	3.07	2.79	3.18
GMOs crops pollinate and their seeds can travel	2.79	2.51	2.29	2.01	2.40
GM crops increased the herbicide use	4.21	4.13	3.91	3.83	4.02
GM plant can result in massive collateral damage that produces new toxins	3.76	3.48	3.26	2.98	3.37
GM crops do not increase yields work against feeding a hungry world	2.14	2.06	1.84	1.76	1.95
Herbicides used of GM plants can harm birds, insects, amphibians and other soil organisms	3.02	2.74	2.52	2.24	2.63
Damaging agro ecosystem	3.34	3.06	2.84	2.56	2.95
Disturbance to natural pollination process	4.15	4.07	3.85	3.77	3.96
Threats to organic farming	2.46	2.18	2.06	1.98	2.17
Genes can end up in unexpected plants	2.78	2.60	2.38	2.20	2.49
Loss of farmers' access to plant materials	3.95	3.67	3.45	3.17	3.56
Terminator technology	4.17	4.09	3.77	3.49	3.88
Genes can mutate with harmful effects	3.10	2.82	2.60	2.32	2.71
Destruction of indigenous farming knowledge	4.19	4.15	4.09	3.97	4.10
Promotion of corporate agriculture	3.46	3.18	2.96	2.68	3.07
Average	3.42	3.20	2.99	2.76	3.09

Source: Computed from the primary data

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*F crit*
Rows	34.99878	20	1.749939	280.3819	1.747984
Columns	5.021124	3	1.673708	268.1679	2.758078
Error	0.374476	60	0.006241		
Total	40.39438	83			

Table 8 presents data on the caste wise respondents' rating on rejection ongenetically modified crop cultivation. The forward caste respondents rank the first position in their overall revealed rejections of genetically modified crop cultivation and it is evident from their secured a mean score of 3.42 on a 5 point rating scale. The backward caste respondents' record the second position in their overall rated possibilities to rejections of genetically modified crop cultivation and it is learnt from their secured a mean score of 3.20 on a 5 point rating scale. The most backward caste respondents register the third position in their overall reflected willingness to rejection genetically modified crop cultivation and it is revealed from their secured a mean score of 2.99 on a 5 point rating scale. The schedule caste respondents come down to the last position in their overall rated rejections of genetically modified crop cultivation as per their secured a mean score of 2.76 on a 5 point rating scale.

The anova two ways model is applied for further discussion. The computed anova value 280.38 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the overall rejections of genetically modified crop cultivation is statistically identified as significant. In another point, the computed anova value 268.16 is greater than its tabulated value at 5 percent level significance. Hence, the variation among the caste groups is statistically identified as significant as per the respondents rating on rejections of genetically modified crop cultivation.

Table 9 Sex Wise Respondents' Rating on Rejection of Genetically Modified Crop Cultivation

Variables	Male	Female	Mean
Transfer of protein from one plant to another	2.79	2.33	2.56
Creating superweeds that have evolved a resistance to glyphosate	3.52	3.06	3.29

Bacterial toxin develops BT resistant crops	3.07	2.61	2.84
Gene migration among species	3.90	3.44	3.67
Degradation of biodiversity	2.54	2.08	2.31
Disturbance to natural food chain	4.02	3.56	3.79
Destruction of honey bees and other natural pollinators	3.41	2.95	3.18
GMOs crops pollinate and their seeds can travel	2.63	2.17	2.40
GM crops increased the herbicide use	4.17	3.87	4.02
GM plant can result in massive collateral damage that produces new toxins	3.60	3.14	3.37
GM crops do not increase yields work against feeding a hungry world	2.01	1.90	1.95
Herbicides used of GM plants can harm birds, insects, amphibians and other soil organisms	2.86	2.40	2.63
Damaging agro ecosystem	3.18	2.72	2.95
Disturbance to natural pollination process	4.19	3.73	3.96
Threats to organic farming	2.30	2.04	2.17
Genes can end up in unexpected plants	2.72	2.26	2.49
Loss of farmers' access to plant materials	3.79	3.33	3.56
Terminator technology	4.11	3.65	3.88
Genes can mutate with harmful effects	2.94	2.48	2.71
Destruction of indigenous farming knowledge	4.15	4.05	4.10
Promotion of corporate agriculture	3.30	2.84	3.07
Average	3.30	2.89	3.09

Source: Computed from the primary data

T Statistical Value 16.34, df 20, T Critical Value 1.72

Data presented in table 9 indicate the sex wise respondents' rating on rejection of genetically modified crop cultivation. The male respondents' rank the first position in their overall rated rejections of genetically modified crop cultivation as per their secured a mean score of 3.30 on a 5 point rating scale. The female respondents hold the second position in their overall rated rejectionsof genetically modified crop cultivation as per their secured a mean score of 2.89 on a 5 point rating scale.

The T test is applied for further discussion. The computed t value 16.34 is greater than its tabulated value at 5 per cent level significance. Hence there is a significant difference between male respondents and female respondents in their overall ratedrejections of genetically modified crop cultivation.

Table 10 Area Wise Respondents' Rating on Rejection of Genetically Modified Crop Cultivation

Variables	Rural	Urban	Mean
Transfer of protein from one plant to another	2.24	2.88	2.56
Creating superweeds that have evolved a resistance to glyphosate	2.97	3.61	3.29
Bacterial toxin develops BT resistant crops	2.52	3.16	2.84
Gene migration among species	3.35	3.99	3.67
Degradation of biodiversity	2.19	2.43	2.31
Disturbance to natural food chain	3.47	4.11	3.79
Destruction of honey bees and other natural pollinators	2.86	3.50	3.18
GMOs crops pollinate and their seeds can travel	2.08	2.72	2.40
GM crops increased the herbicide use	3.90	4.14	4.02
GM plant can result in massive collateral damage that produces new toxins	3.05	3.69	3.37
GM crops do not increase yields work against feeding a hungry world	1.83	2.07	1.95
Herbicides used of GM plants can harm birds, insects, amphibians and other soil organisms	2.31	2.95	2.63
Damaging agro ecosystem	2.63	3.27	2.95
Disturbance to natural pollination process	3.74	4.18	3.96
Threats to organic farming	2.05	2.29	2.17
Genes can end up in unexpected plants	2.17	2.81	2.49

Loss of farmers' access to plant materials	3.24	3.88	3.56
Terminator technology	3.56	4.20	3.88
Genes can mutate with harmful effects	2.39	3.03	2.71
Destruction of indigenous farming knowledge	4.02	4.18	4.10
Promotion of corporate agriculture	2.75	3.39	3.07
Average	2.82	3.36	3.09

Source: Computed from the primary data

T Statistical Value 13.37, df 20, T Critical Value 1.72

Data presented in table 10 indicate the area wise respondents' rating on rejection of genetically modified crop cultivation. The urban respondents' rank the first position in their overall rated rejections of genetically modified crop cultivation as per their secured a mean score of 3.36 on a 5 point rating scale. The rural respondents hold the second position in their overall rated rejections of genetically modified crop cultivation as per their secured a mean score of 2.82 on a 5 point rating scale.

The T test is applied for further discussion. The computed t value 13.37 is greater than its tabulated value at 5 per cent level significance. Hence there is a significant difference between urban respondents and rural respondents in their overall ratedrejections of genetically modified crop cultivation.

Conclusion

It could be seen clearly from the above discussion that the respondents' rate the high level acceptances on genetically modified organismsby citing the indicators of ornamental garden plants with new properties, animals reared as donors for GM organ transplants, GM plants for plant made pharmaceuticals, plants for human food with improved quality characteristics of fruits and micro organisms with the ability to synthesize applicable organic acid as per their secured a mean score above 3.50 on a 5 point rating scale. The respondents' rate the moderate level acceptancesongenetically modified organisms by stating the indicatorsthatGM trees designed for industrial and energy purpose, production of milk producing animals that milk containing medical substances, Crop plants with increased tolerance to salinity and drought condition, micro organisms that can degrade toxic substances previously biologically non degradable, cultivation of GM plants on a small scale for some specific crops, GM plants for phytoremediation, plants used for producing biofuels, genetically modified viruses designed for the transfer of genes between organisms and ornamental house plants with new propertiesas per their secured a mean score in the range of 2.50 to 3.50 on a 5 point rating scale. The respondents' rate the low level acceptancesongenetically modified organismsby way of developinganimal for food consumption having meat with improved characteristics, plants for animal food resistance to pests and pathogens, domestic animals with new properties, micro organisms with the ability to synthesize medical substances like insulin and plants for human food resistant to pests and pathogens as per their secured a mean score below 2.50 on a 5 point rating scale. It could be observed that the government department agriculture scientist respondents'rank the first position in their rated overall acceptances towards genetically modified organisms, scientists of research institutions the second, university agriculture scientist respondents' the third, and agriculture scientist in college respondents' the last.

The education wise result of analysis reveals that the doctorate degree level educated respondents rank the first position in their overall rated desire to accept thegenetically modified organisms, M.Phil degree level educated respondents' the second, Masters' degree level educated respondents' the third and under graduate degree level educated respondents' the last. The caste wise result of analysis reveals that the forward caste respondents rank the first position in their overall revealed desire to accept the genetically modified organisms, backward caste respondents' the second, most backward caste respondents' the third and scheduled caste respondents' the last. The gender wise result of analysis revealsthat the female respondents lag behind the male respondents in their overall ratedacceptance ongenetically modified organisms.The area wise result of analysis revealsthat the rural respondents lag behind the urban respondents in their overall ratedacceptance ongenetically modified organisms.

The findings of respondents rating on rejection of genetically modified crop cultivation reveal the following facts. The respondents' rate the high level rejections of genetically modified crop cultivationby citing the indicators of destruction of indigenous farming knowledge, GM crops increased the herbicide use, disturbance to natural pollination process, terminator technology, disturbance to natural food chain, gene migration among species

and loss of farmers' access to plant materialsas per their secured a mean score above 3.50 on a 5 point rating scale. The respondents' rate the moderate level rejections of genetically modified crop cultivation by stating the indicators that GM plant can result in massive collateral damage that produces new toxins, creating superweeds that have evolved a resistance to glyphosate, destruction of honey bees and other natural pollinators, promotion of corporate agriculture, damaging agro ecosystem, bacterial toxin develops BT resistant crops, genes can mutate with harmful effects, herbicides used forGM plants can harm birds, insects, amphibians and other soil organisms and transfer of protein from one plant to another as per their secured a mean score in the range of 2.50 to 3.50 on a 5 point rating scale. The respondents' rate the low level rejections of genetically modified crop cultivationby way of genes can end up in unexpected plants, GMOs crops pollinate and their seeds can travel, degradation of biodiversity, threats to organic farming and GM crops do not increase yields work against feeding a hungry worldas per their secured a mean score below 2.50 on a 5 point rating scale. It could be observed that the government department agriculture scientistsrank the first position in their rated overall rejection of genetically modified crop cultivation, scientists of research institutions the second, university agriculture scientists respondents' the third, and college agriculture scientiststhe last.

The result of education wise analysis reveals that the doctorate degree level educated respondents rank the first position in their overall rated rejections of genetically modified crop cultivation, M.Phil degree level educated respondents' the second, Masters' degree level educated respondents' the third and under graduate degree level educated respondents' the last. The result of caste wise analysis reveals that the forward caste respondents rank the first position in their overall revealed rejections of genetically modified crop cultivation, backward caste respondents' the second, most backward caste respondents' the third and scheduled caste respondents' the last. The result of gender wise analysis revealsthat the female respondents lag behind the male respondents in their overall ratedrejections of genetically modified crop cultivation.The result of area wise analysis revealsthat the rural respondents lag behind the urban respondents in their overall ratedrejections of genetically modified crop cultivation.

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