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CHEMICAL AND STATICAL STUDY OF CHLORINATED PESTICIDES AND BIOFERTILIZER ON GROWTH PARAMETERS OF COTTON CULTIVATION FROM DIFFERENT VILLAGES OF NAGAUR DISTRICT IN RAJSTHAN (INDIA)

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ABSTRACT:

In this Study, eight villages of Nagaur district were selected to see the effect of chlorinated pesticide and biofertilizer on growth parameters cotton cultivation. One field is selected from each village and make four plots in that field, in which P-1 plot is treated as normal, P-2 plot is treated with pesticide, P-3 plot is treated with biofertilizer and P-4 plot is treated with both pesticide and biofertilizer. In cotton seed treatment, Ampligo is used as insecticide and PSB as biofertilizer, Tubeconozole as fungicide in soil treatment and Trichoderma viridi as biofertilizer. Comparative study of growth parameters of cotton after 40 days and 80 days after sowing of crop. The growth parameters of the plot in which pesticide and biofertilizer were used were found to be good. Pesticides and biofertilizers were not sprayed in any plot for 40 days and sprayed after 40 days. Biofertilizer and pesticides were not sprayed in P-1 plot of cotton.

KEYWORDS: Cotton, Seed Treatments, Soil Treatment, Ampligo, Tubeconozole, Trichoderma viride, Chemical Spray.

1. Introduction:

Cotton, the most important fibre crop of India plays a dominant role in its agrarian and industrial economy. It is the backbone of our textile industry, accounting for 70% of total fibre consumption in textile sector, and 38% of the country's export, fetching over Rs. 42,000 crores. Area under cotton cultivation in India (8.9 million ha) is the highest in the world, i.e., 25% of the world area and employs seven million people for their living [1]. Cotton is a difficult crop to grow: yields can be decimated by severe weather (both droughts and flooding) and it is particularly vulnerable to pest attacks. **Globally, this crop covers just 2.4% of the world's cultivated land but used 4.7% of the world's pesticides (and 10% of insecticides)** in 2019, according to the International Cotton Advisory Committee. It is one of the world's most pesticide intensive crops. These issues often combine to create disastrous economic, health and environmental consequences for many smallholder growers. Cotton farming is of marginal profitability

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for many small farmers. Some can earn less than two dollars a day from their cotton. They receive little support or training and yields are low [2]. Smallholder cotton farmers spend up to 60% of their annual income on pesticides. Farmers buy agrochemicals on credit at the start of the season and often yields at the end of the season are too meagre to pay off these costs – just one bad harvest can tip a farmer into debt. The main threat to crop production in many countries is salinization and 33% of the world's potential arable land already affected by salinity in different level, whereas 950 million ha of salt-affected lands occur in arid and semi-arid regions including almost 60% cotton fields of Uzbekistan [3]. Although, the cotton is considered one of the most salt tolerant crop in arid regions but the increasing of salination retards it's growth and yield seriously. The increase of salinity caused by irrigation of cultivated lands with saline water, poor agricultural management and drainage systems, and low precipitation. In Uzbekistan, by 1990 the area of the irrigated lands has increased by 1, 6 times, as much as the agriculture production has increased, although salinity and drought became the main factors of crop losses that causing a concern in coping with increasing food requirements [4,5]. Moreover, the massive use of agrochemicals has damaged the natural resources and environment in Aral Sea basin of Uzbekistan which is almost impossible to recover in the future. The ability of plants to take up water are inhibited by salinity stress, causing ion imbalance and, in turn, resulting in a reduction of root and shoot growth [6]. Several reports indicated that salinization is the serious threat to sustainable agricultural crop production system and to soil resources. The improving soil quality and fertility by novel technologies is pivotal for the increase of cotton production in Uzbekistan. Importance of bacterial fertilizers is increasing in worldwide, as it may substantially reduce the use of chemical fertilizers and pesticides which often contribute to the pollution of crop fields and environmental ecosystems [7]. Current study revealed the prospects of local produced biofertilizers to increase cotton production and it's capabilities to improve growing condition of cotton in both favourable and salinated arid conditions of Uzbekistan. Moreover, these potential biological fertilizers protect the environment as eco-friendly and cost effective inputs for the farmers, also reduce the use of chemical fertilizers [8].

2. Literature Review:

India has the distinction of having the largest area under cotton cultivation which is about 41% of the world area under cotton cultivation between 12.5 million hectares to 13.5 million hectares [9].

Organochlorine pesticides (OCPs) have attracted widespread concern because of their environmental persistence and toxicity. The historical influence of different agricultural land use types on soil concentrations of OCP residues was investigated by collecting a total of 52 surface soil samples from long-term cotton fields and fields with other crops in Lvdian township, Henan province, eastern central China. The concentration, composition, and possible sources of 16 OCPs were determined and a health risk

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assessment of these soils was conducted. Hexachlorocyclohexane (HCH), heptachlor, chlordane, and dichloro diphenyl trichloroethane plus its main metabolites (DDTs) were the most frequently detected OCPs with concentrations of 2.9–56.4 ng g^{-1}, 4.3–14.0 ng g^{-1}, 18.0–1254.4 ng g^{-1}, and below detection limit (BDL) −206.1 ng g^{-1}, respectively. Analysis of variance of p,p-DDE shows significant ($P < 0.05$) differences while other OCPs show no significant differences between historical cotton fields and fields containing other crops[10,11]. Compositional analysis suggests that the HCH is derived mainly from the use of lindane and that there are recent inputs. Analysis of variance and compositional analysis indicate that the p,p-DDE in surface soil from long-term cotton fields is derived mainly from the aerobic biodegradation of historical residues. The sum of carcinogenic risk values of OCPs for soil samples were found to be 1.58×10^{-6}, posing a low cancer risk to the inhabitants of the region studied. Residues of organic contaminants including toxaphene, DDT, trifluralin, hexachlorocyclohexanes, polychlorinated biphenyls, polycyclic aromatic hydrocarbons (PAHs) and nonylphenol were measured in 32 cotton field soils collected from South Carolina and Georgia in 1999. Toxaphene, trifluralin, DDT and PAHs were the major contaminants found in these soils. The maximum concentration of toxaphene measured was 2,500 ng/g dry weight. Trifluralin was detected in all the soils at concentrations ranging from 1 to 548 ng/g dry weight [12,13]. Pesticide residues were not proportional to soil organic carbon content, indicating that their concentrations were a reflection of application history and dissipation rates rather than air–soil equilibrium. Soil extracts were also subjected to in vitro bioassays to assess dioxin like, estrogenic, and androgenic/glucocorticoid potencies. Relatively more polar fractions of the soils elicited estrogenic and androgenic/glucocorticoid activities, but the magnitude of response was much less than those found in coastal marine sediments from industrialized locations [14]. Soils polluted by persistent organic pollutants threatens habitats for plants and animals as well as basic human needs such as food security and provision of potable water. Toxaphene is a persistent organic pollutant that was heavily used as a pesticide in Central America, Brazil, Soviet Union etc. until it was banned in 1993. The objective of this study was to determine the bioaccumulation and translocation characteristics of three different cultivars of amaranth in soils contaminated with field-weathered toxaphene and other POPs in former cotton fields in Chinandega, Nicaragua to identify safety issues for human consumption and/or potential for phytoremediation. The concentration of toxaphene and other POPs in the edible parts of the amaranth (leaves and seeds) exceeded the maximum residue level for human consumption established by the European Union for most of the tested compounds. Concentrations of toxaphene congeners and other POPs were found in all vegetative organs. Many substances were accumulated to concentrations more than 10 times higher than in the soil. Of the three cultivars, *A. caudatus ‘CAC48 Peru and A. cruentus ‘Don Leon'* presented the highest average BAF. None of the 3 cultivars can be considered a panacea hyperaccumulator for either toxaphene alone or in conjunction with other POPs but since many agricultural soils comprise a range of different contaminants, the broad-spectrum bioaccumulating capacity of amaranth can make it an interesting candidate for phytoremediation [15].

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Dicofol with high impurity of DDT compounds is still widely used in agricultural practice such as cotton cultivation and becomes an important source of DDT pollution in China. In this study, investigations on the DDT residues in cotton fields from northern Jiangsu province, China were conducted. The results showed that DDTs in cotton soil were much higher than other mode of land use. The DDTs levels ranged from 4.2 to 678.6 ng g^{-1}, with a mean concentration of 190.4 ng g^{-1}, of which the most abundant compounds were *p*,*p′*-DDE (mean of 129.38 ng g^{-1}), *p*,*p′*-DDT (mean of 26.57 ng g^{-1}) and *o*,*p′*-DDT (mean of 16.92 ng g^{-1}). The concentrations of *o*,*p′*-DDT and *o*,*p′*-DDE were significantly higher ($p < 0.05$) in topsoil (0–10 cm) than in subsoil (10–20 cm), while other DDT compounds were not. Source apportionment showed that dicofol-type DDT accounted for up to 80% of the DDTs residue. All the results indicated that dicofol applications resulted in serious DDT pollution in cotton fields. Our work provided implications for reasons why there was no apparent decrease of DDT level in China. 99% of the world's cotton farmers live and work in the developing world where low levels of safety awareness, lack of access to protective apparatus, illiteracy, poor labelling of pesticides, inadequate safeguards, and chronic poverty each exacerbate the damage caused by cotton pesticides to low income communities [16]. Together developing world farmers are responsible for producing 75% of global cotton production. The world's cotton farmers produce around 34 million tonnes of cottonseed annually in addition to the fibre. Cottonseed is used as an animal feed and, in the form of cottonseed oil, as a common cooking product accounting for approximately 8% of the world's vegetable oil consumption. Data compiled by FAO/WHO show the potential for pesticides to contaminate both refined cottonseed oil and cottonseed derivatives fed to animals. A 2004 study conducted by researchers at the Technical University of Lodz, in Poland, has shown that hazardous pesticides applied during cotton production can also be detected in cotton clothing. In the Indian cotton growing season of 2005, researchers set out to investigate the impact of acute pesticide poisoning on cotton farmers living in three villages in Andhra Pradesh [17]. The scientists recruited 50 female cotton growers who were asked to record the adverse health impacts experienced by themselves and by one designated male relative. While the design of the experiment was simple, the evidence it uncovered was deeply disturbing. Over a five month growing season, the 97 cotton labourers involved in the study experienced a total of 323 separate incidents of ill health, of which 83.6% were associated with signs of mild to severe pesticide poisoning. Reported symptoms included burning eyes, breathlessness, excessive salivation, vomiting, nausea, dizziness, blurred vision, muscle cramp, tremors, loss of consciousness and seizures. In total up to 10% of all spraying sessions were associated with three or more neurotoxic or systemic symptoms. In reporting their study, the scientists behind the investigation described India's 10 million cotton farmers as working in a highly unsafe occupational environment where protective measures and equipment for the safe handling and spraying of pesticides are far from being adopted; people work bare-foot and bare-handed wearing only traditional sarongs; cotton farmers are directly exposed to pesticides for between 3 and 4 hours per spraying session, and concentrated chemical products are mixed with water using bare hands. These

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harrowing observations of farmers exposed to hazardous pesticides are not untypical of cotton production in the developing world [18]. Yet they stand in stark contrast to the overtly safety conscious shopping malls of Western Europe and America, where newly washed tile floors are earmarked with notices warning shoppers not to slip. However, despite the scant similarities between the developing world's 27 million cotton farmers and Western consumers, the two groups are inextricably linked by cotton: the world's most important non-food agricultural commodity a fibre we now produce and consume in greater abundance than ever before. Introduction the deadly chemicals in cotton 5 up to 99% of the world's cotton farmers live and work in developing world countries; with almost two-thirds residing in either India or China, and with many of the remainder located in West Africa, or South America. Predominantly members of the rural poor, these smallholders typically cultivate cotton on plots of less than one-half hectare, or on parts of their farms, as a means of supplementing their income [19]. But the cultivation of cotton comes at an appalling price. Between them, the world's cotton farmers are responsible for handling US$ 2 billion of agrochemicals every year; US$ 819 million of which are toxic enough to be classified as hazardous by the World Health Organisation. These chemicals include some of the most poisonous substances applied to crops anywhere in the world and they are commonly used in developing countries without any of the safeguards, regulations or protections expected in the West. In total almost one kilogram of hazardous pesticides is applied per hectare under cotton, and cotton is responsible for 16% of global insecticide usage a figure higher than any other single crop. The risks these farmers take are exacerbated by the circumstances of their relative poverty, lack of effective regulation systems, poor labelling of pesticides, illiteracy, insufficient knowledge of pesticide hazards, and lack of protective equipment, each acting to sponsor exposure to hazardous pesticides. This report reveals the way in which most of the developing world's cotton farmers work and the hazardous pesticides which contaminate their environment and threaten their health [20]. It presents an astonishing picture of the harm caused to supply wealthy, predominantly western consumers, and with it, presents a compelling case for immediate action by all parties involved: business, consumers, politicians, unions, and farmers. Pesticides used for cotton production and pest control in the growing of food crops such as beans, maize and vegetables eventually may not only end up on the crops, but also in soil and surface water. As a consequence, aquatic organisms and humans consuming crops may experience pesticide exposure. This also is the case in developing countries in Africa, where pesticide use sometimes is less controlled and includes the use of older organochlorinated products. This study assessed the public health risk due to pesticide exposure along the Kiti River in the Dridji cotton-growing area in the Republic of Benin. Aquatic organisms from the Kiti River and vegetable plants commonly consumed by the local people were analyzed for residues of organochlorinated pesticides. Kiti River sediment contained metabolites of DDT with levels up to 5.14 μg/kg dry weight. In fish, crabs and amphibians collected from the Kiti River DDT-like compounds and α-endosulfan reached levels up to 403 ng/g lipid. Leaves from beans grown in the river floodplain and consumed by the local population were contaminated with 10 pesticides

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including DDT-like compounds, α endosulfan, dieldrin, lindane, hexachlorobenzene and heptachlor. Sum DDT concentrations in the bean leaves ranged between 274 and 1351 µg/kg dry weight, while these vegetables also contained endosulfan (23-210 µg/kg dry weight), dieldrin. In a program to assess and monitor soil quality, the term soil quality was used interchangeably with soil health and, in spite of the wider context in which it was presented, defined primarily from an agricultural perspective as “the soil's fitness to support crop growth without becoming degraded or otherwise harming the environment [21,22]”. The term soil health originates from the observation that soil quality influences the health of animals and humans via the quality of crops. Indeed, linkages to plant health are common, as in the case of disease-suppressive soils. Soil health has also been illustrated via the analogy to the health of an organism or a community. The debate about soil quality vs. soil health arose quickly after the concept of soil quality was criticized in the 1990s. In contrast to soil quality, soil health would “capture the ecological attributes of the soil which have implications beyond its quality or capacity to produce a particular crop. These attributes are chiefly those associated with the soil biota; its biodiversity, its food web structure, its activity and the range of functions it performs” [23]. These authors further consider “that the term soil health encompasses the living and dynamic nature of soil, and that this differentiates it from soil quality”. They therefore “adopt the view that although the concepts of soil quality and soil health overlap to a major degree and that in many instances the two terms are used synonymously, soil quality focuses more on the soil's capacity to meet defined human needs such as the growth of a particular crop, whilst soil health focuses more on the soil's continued capacity to sustain plant growth and maintain its functions”[24]. Meanwhile, the debate subsided and partly changed focus.

Of the earth’s crust in which are mixed organisms and products of their death and decay. It may

Also be defined as the part of the earth’s crust in which plants are anchored. The soil is a complex organization being made up of some six constituents’ namely inorganic matter, organic matter,

Soil organisms, soil moisture, soil solution and soil air. Roughly, the soil contains 50-60% mineral matter, 25-35% water, 15-25% air and little percentage of organic matter. The soil pollution due to sewage is also very high. Several diseases are inflicted in human beings due to pathogenic forms present in the soil. It is the need of time that we have to study the physicochemical parameters of soil to know quality. Twenty representative samples were collected from various parts of the Kadi taluka and its physicochemical analysis have been performed to know its different parameters like pH, Electrical Conductivity, Phosphorous, Potassium, Sulfur, Carbon and Boron.

3. Study Area:

1. Inana (V-1), 2. Kuchera (V-2), 3. Gaju (V-3) , 4. Chhilra (V-4), 5. Balaya (V-5)

6 .Parashara (V-6) ,7. Silariya (V-7), 8. Dehroli (V-8)

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4. Research Methodology:

We used Bt Co II variety in our study area. The combined effect of pre-sowing **seed** treatment and varieties showed significant effect for growth and **seed** yield characters of cotton.

Binomial name - *Gossypium hirsutum*

Scientific classification	
Kingdom:	Plantae
Clade:	Tracheophytes
Clade:	Angiosperms
Clade:	Eudicots
Clade:	Rosids
Order:	Malvales
Family:	Malvaceae
Genus:	*Gossypium*
Species:	***hirsutum***

4.1 Seed Details of Used BT Co-II Cotton Seed:

Shelf Life	**1 Year**
Variety	Bt Co-II
Seed Class	TFL
Packaging Type Available	Packet
Packaging Size Available	1 kg
Price	Rs 740/kg
Color	Yellow

4.2 Personal Protective apparatus: Gloves, Long Sleeves, Boots & Mask etc.

Tools – These tools were used in soil sampling

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Khurpi, Auger, Spade, Pen- Paper, Sieve, Plastic Bag, Banner and Board etc.

4.3 Methodology of Seed Treatment in Cotton Plots:

Table -1: Show Readings of Seed Treatment in Cotton four plots

S. No.	Plot -1	Plot - 2	Plot - 3	Plot - 4
Plant Treat.	Soil + Cotton	Soil + Cotton + Pesticides	Soil + Cotton + Bio-fertilizer	Soil + Cotton + Bio-fertilizer + Pesticides
Seed Treat.	----	**Seed Treatment** (Ampligo Insectisides)	**Seed Treatment** (PSB-Phosphorus Solubilizing Bacteria Biofertilizer)	**Seed Treatment** (Ampligo Insectisides and PSB)
Usage for Total seeds (5kg)	----	2ml 5lit water	25ml 300ml water	2ml 5lit water + 25ml 300ml water

4.4 Methodology of Soil Treatment in Cotton Plots:

Table -2. Show Readings of Soil Treatment in Cotton four plots

S. No.	Plot -1	Plot - 2	Plot - 3	Plot - 4
Plant Treat.	Soil + Cotton	Soil + Cotton +Pesticides	Soil + Cotton + Bio-fertilizer	Soil + Cotton+ Pesticides+ Bio-fertilizer
Soil Treat	----	**Soil Treatment** (Tubeconazole Fungisides Spray)	**Soil Treatment** (Trichoderma viride Biofertilizer)	**Soil Treatment** (Tubeconazole and Trichoderma viride)
Dosage Per hact.	----	750ml 750lit water	10kg (powder) 2qt. cow dung	750ml 750lit water + 10kg (Powder) 2qt. cow dung

4.5 Seed weight & Sow- Seed variety Bt Co-II was weighed by weighing balance. After that the seeds sowed by hand in each plot.

4.6 Chemicals & Bio agents- These were weighed by weighing balance. After that the pesticides and bio-fertilizer sprayed by sprayer in each plot.

4.7 Seed Germination & Seedling Growth - Germination percentage is an estimate of the viability of a population of seeds. The equation to calculate germination percentage is:

SGP = seeds germinated/total seeds x 100 .

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The germination rate provides a measure of the time course of seed germination.

Fig.1: Shows the Measurement of Cotton Plot after 40 days of sowing.

Fig.2: Shows the Measurement of Cotton Plot after 80 days of sowing.

5 Data Analysis:

5.1 Recording of readings of plant growth parameters of cotton crop after 40 days of sowing in eight villages at Nagaur region.

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5.1.1 Inana Village

Table -3: Readings of plant growth parameters of cotton crop after 40 days of sowing in Inana village.

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	16-21cm	23-27cm	21-26cm	25-30cm
5	No. of Plants	6	6	6	6
6	No. of Branches	5-6	7-9	6-8	8-10
7	Root Height	4-5cm	5-6cm	4-6cm	6-7cm
8	No. Root Branches	5-6	9-11	5-8	9-12
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

5.1.2 Kuchera Village

Table -4: Readings of plant growth parameters of cotton crop after 40 days of sowing in Kuchera village.

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	24-27cm	30-34cm	29-31cm	33-38cm
5	No. of Plants	6	6	6	6
6	No. of Branches	7-10	10-14	9-12	12-15
8	Root Height	5-6cm	6-9cm	4-7cm	9-11cm
9	No. Root Branches	8-10	14-16	10-12	16-18
10	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

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5.1.3 Gaju Village

Table -5. Readings of plant growth parameters of cotton crop after 40 days of sowing in Gaju village

1	No. of Plot (4)	P-1	P-2	P-3	P-4
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	22-26cm	28-31cm	27-30cm	31-36cm
5	No. of Plants	6	6	6	6
6	No. of Branches	5-9	9-13	8-10	10-13
7	Root Height	4-6cm	5-8cm	4-6cm	8-10cm
8	No. Root Branches	7-9	12-14	8-11	14-17
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

.

5.1.4 Chhilra Village

Table -6. Readings of plant growth parameters of cotton crop after 40 days of sowing in Chhilra village

1	No. of Plot (4)	P-1	P-2	P-3	P-4
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	27-30cm	35-38cm	33-36cm	38-43cm
5	No. of Plants	6	6	6	6
6	No. of Branches	10-13	15-18	12-15	15-20
7	Root Height	5-8cm	7-11cm	5-9cm	10-13cm
8	No. Root Branches	8-12	16-18	12-15	18-20
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

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5.1.5 Balaya Village

Table -7. Readings of plant growth parameters of cotton crop after 40 days of sowing in Balaya village.

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	25-28cm	32-36cm	30-32cm	35-40cm
5	No. of Plants	6	6	6	6
6	No. of Branches	8-11	12-16	10-13	13-17
8	Root Height	5-7cm	6-10cm	5-8cm	9-12cm
9	No. Root Branches	8-11	15-17	11-13	17-20
10	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

5.1.6 Parashara Village

Table -8. Readings of plant growth parameters of cotton crop after 40 days of sowing in Parashara village.

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	29-33cm	37-40cm	34-39cm	40-45cm
5	No. of Plants	6	6	6	6
6	No. of Branches	12-15	17-20	14-18	18-22
7	Root Height	6-10cm	9-13cm	7-10cm	11-15cm
8	No. Root Branches	10-13	18-21	14-16	20-22
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

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E-Publication Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/7938D

5.1.7 Silariya Village

Table -9. Readings of plant growth parameters of cotton crop after 40 days of sowing in Silariya village

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	20-24cm	26-30cm	25-29cm	30-35cm
5	No. of Plants	6	6	6	6
6	No. of Branches	5-8	8-12	7-9	9-12
7	Root Height	4-5cm	5-7cm	4-6cm	8-9cm
8	No. Root Branches	6-8	11-13	7-10	12-15
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

5.1.8 Dehroli Village

Table -10. Readings of plant growth parameters of cotton crop after 40 days of sowing in Dehroli village.

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	18-22cm	24-29cm	23-28cm	28-32cm
5	No. of Plants	6	6	6	6
6	No. of Branches	5-7	8-10	6-9	9-11
7	Root Height	4-5cm	5-6cm	4-6cm	7-8cm
8	No. Root Branches	5-7	10-12	6-9	10-14
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/7938D

5.2 Recording of readings of plant growth parameters of cotton crop after 80 days of sowing in eight villages at Nagaur region.

5.2.1 Inana Village

Table -11. Readings of plant growth parameters of cotton crop after 80 days of sowing in Inana village.

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	50-55cm	58-62cm	57-61cm	66-70cm
5	No. of Plants	6	6	6	6
6	No. of Branches	10-15	15-18	16-20	20-25
7	Root Height	9-12cm	9-15cm	8-13cm	10-15cm
8	No. Root Branches	6-10	10-13	9-12	10-15
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

5.2.2 Kuchera Village

Table -12: Readings of plant growth parameters of cotton crop after 80 days of sowing in Kuchera village.

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	58-63cm	68-72cm	65-70cm	74-77cm
5	No. of Plants	6	6	6	6
6	No. of Branches	16-21	25-28	24-26	27-30
7	Root Height	14-17cm	16-21cm	15-19cm	18-25cm
8	No. Root Branches	12-17	17-19	14-17	17-21
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/7938D

5.2.3 Gaju Village

Table -13. Readings of plant growth parameters of cotton crop after 80 days of sowing in Gaju village.

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	56-60cm	65-70cm	62-68cm	72-75cm
5	No. of Plants	6	6	6	6
6	No. of Branches	15-20	23-25	22-25	25-29
7	Root Height	12-16cm	14-20cm	13-18cm	16-23cm
8	No. Root Branches	10-15	15-18	12-16	15-20
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

5.2.4 Chhilra Village

Table -14. Readings of plant growth parameters of cotton crop after 80 days of sowing in Chhilra village.

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	63-67cm	73-78cm	69-74cm	78-81cm
5	No. of Plants	6	6	6	6
6	No. of Branches	22-26	29-32	27-30	30-33
7	Root Height	16-19cm	19-25cm	17-21cm	22-28cm
8	No. Root Branches	14-18	18-21	16-19	20-23
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/7938D

5.2.5 Balaya Village

Table -15. Readings of plant growth parameters of cotton crop after 80 days of sowing in Balaya village.

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	60-65cm	70-75cm	67-71cm	76-80cm
5	No. of Plants	6	6	6	6
6	No. of Branches	18-23	27-30	25-27	28-31
7	Root Height	15-18cm	18-23cm	16-20cm	20-26cm
8	No. Root Branches	13-18	18-20	15-18	18-22
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

5.2.6 Parashara Village

Table -16. Readings of plant growth parameters of cotton crop after 80 days of sowing in Parashara village.

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	68-70cm	76-80cm	71-77cm	80-83cm
5	No. of Plants	6	6	6	6
6	No. of Branches	25-28	31-34	29-32	32-35
7	Root Height	18-21cm	22-27cm	19-24cm	25-30cm
8	No. Root Branches	16-19	20-24	18-22	23-26
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/7938D

5.2.7 Silariya Village

Table -17. Readings of plant growth parameters of cotton crop after 80 days of sowing in Silariya village.

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	54-58cm	62-68cm	60-65cm	70-73cm
5	No. of Plants	6	6	6	6
6	No. of Branches	13-18	20-22	20-23	24-28
7	Root Height	11-14cm	12-18cm	11-15cm	13-20cm
8	No. Root Branches	9-14	13-16	11-15	13-18
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

5.2.8 Dehroli Village

Table -18. Readings of plant growth parameters of cotton crop after 80 days of sowing in Dehroli village

1	**No. of Plot (4)**	**P-1**	**P-2**	**P-3**	**P-4**
2	Quantity of Pesticides/ hac.	-	Amp(2ml) Tebuc(750ml)	-	Amp(2ml) Tebuc(750ml)
3	Quantity of Bio-Fertilizer/ hac.	-	-	PSB (25ml) Td(10kg)	PSB (25ml) Td(10kg)
4	Plant Height	51-56cm	60-65cm	58-63cm	68-71cm
5	No. of Plants	6	6	6	6
6	No. of Branches	11-17	18-20	18-21	21-26
7	Root Height	10-13cm	10-16cm	10-14cm	11-17cm
8	No. Root Branches	8-12	11-15	10-13	12-16
9	Crop Geometry	30x40cm	30x40cm	30x40cm	30x40cm

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Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)
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E-Publication Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/7938D

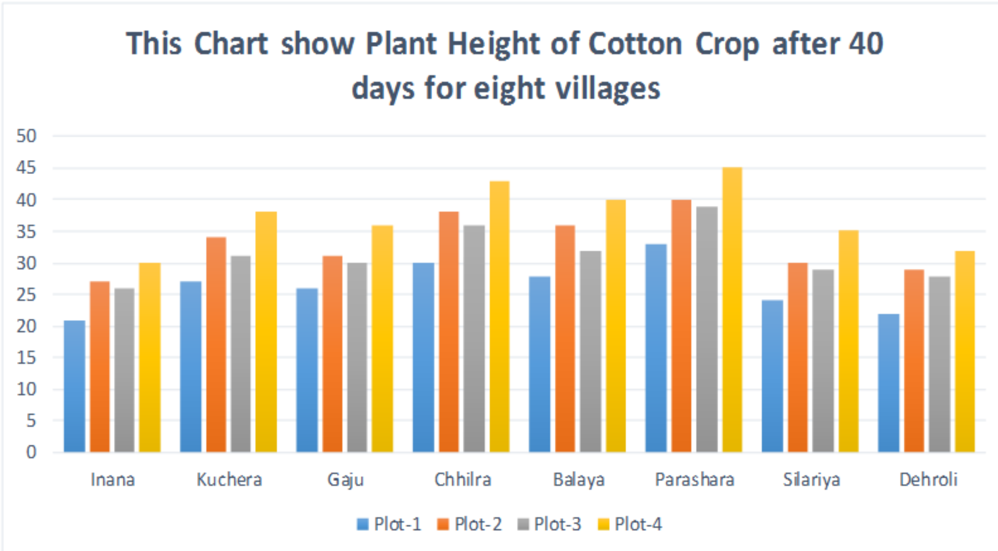

Fig.3 shows that Plant Height of Cotton crop after 40 days in four plots for eight villages.

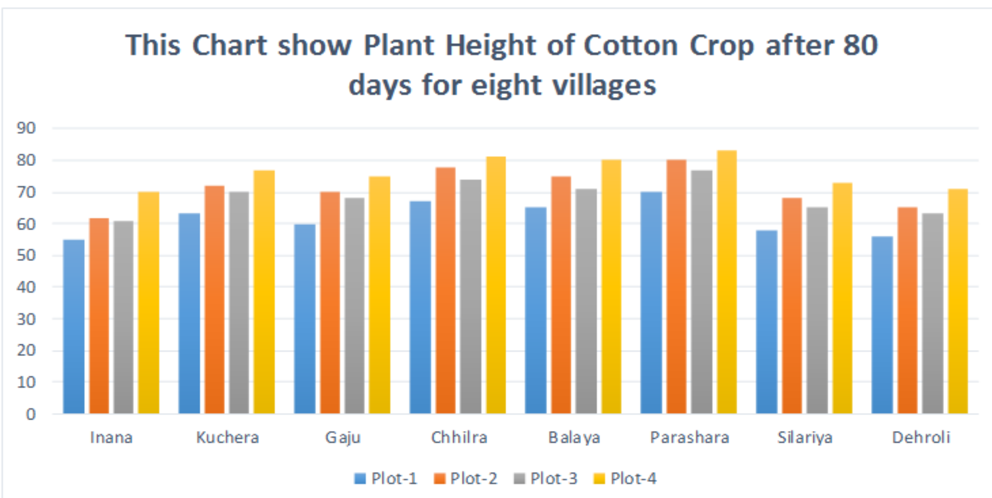

Fig.4 shows that Plant Height of Cotton crop after 80 days in four plots for eight villages.

6. Conclusion:

Pesticides and biofertilizers were not sprayed in any plot for 40 days and sprayed after 40 days. Biofertilizer and pesticides were not sprayed in P-1 plot of cotton, which yielded less seed germination percentage and in P-4 plot both biofertilizer and pesticide were used together, which yielded higher seed germination percentage. Within 40 days of sowing cotton seeds, weeds occurred in very large quantity due to no spray of any kind of pesticides and biofertilizers and after 40 days, weed occurred in very less quantity due to spraying of pesticides and biofertilizers. The growth of plant height, root height, no. of spikes and no. of root branches become normal due to not spraying any kind of pesticides and biofertilizer and spraying of pesticides and biofertilizer accelerated plant growth. The disease resistance was higher in 80 days crop as compared to 40 days cotton days. The highest value of plant height and root height were found in Parashara Village and lowest Value were found in Inana Village. Because the soil of Parashara village is OC, Fe, K and P were highest and pH was lowest, Inana village is OC, Fe, K and P were lowest and pH was highest.

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E-Publication Online Open Access
Vol: 41 Issue: 10-2022
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