Study the Effect of Chlorinated Pesticides on Cumin Cultivation from Different Villages of Nagaur District (Rajasthan) India

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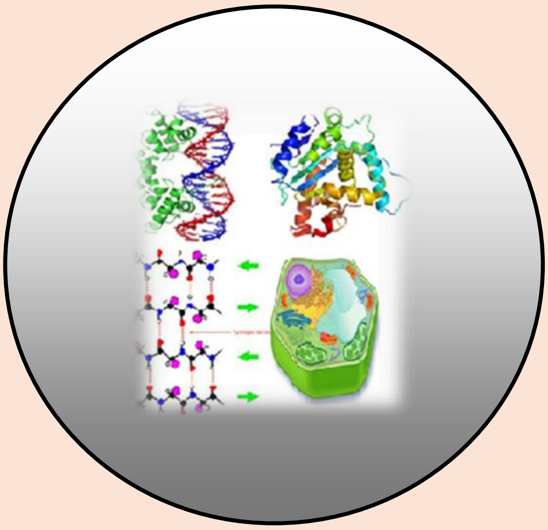

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Study the Effect of Chlorinated Pesticides on Cumin Cultivation from Different Villages of Nagaur District (Rajasthan) India

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ABSTRACT

In this Study, eight villages of Nagaur district were selected to see the effect of chlorinated pesticide in the production of cumin. 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 bio fertilizer and P-4 plot is treated with both pesticide and bio fertilizer. In cumin seed treatment, Ampligo is used as insecticide and PSB as bio fertilizer, Tubeconozole as fungicide in soil treatment and Trichodermaviridi as bio fertilizer. The production of P-4 plot of each village in cumin study was good as it used both pesticide and bio fertilizer and the lowest production was in P-1 plot of each village as no chemicals were used in it. The mean value of Total Production and Profit Cost Ratio in cumin studies obtained as follows. The mean value of the four plots of the total production is as follows P1- 5.53, P2- 8.66, P3 – 6.98 and P4 – 10.34q/ hc. The mean value of the four plots of Profit Cost Ratio is as follows P1- 3.43, P2- 3.72, P3 – 3.07 and P4 – 4.31.
Keywords: Cumin, Seed Germinations, Growth Parameters, Yield Parameters, Economical Parameters, Seed Treatments, Soil Treatment, Ampligo, Tubeconozole, PSB, Trichodermaviride, Yield Seeds weight, Straw weight, Seed weight, Chemical Spray and Seed variety GC-4 etc.

INTRODUCTION

Nagaur district is in the central part of Rajasthan. It is bounded in the north by Bikaner and Churu districts, in the east by Sikar and Jaipur, south by Pali and Ajmer districts and the western boundary is bounded by Jodhpur district. The Map Position of Nagaur District. It's 26° 24' to 27° 42' north latitude and 73° 04' to 75° 22' east longitude. Total Area of Nagaur District - 17,805 sq km. Nickname of Nagaur - Ahichhatrapur, Metal City or City of Tools. Total Forest Area in Nagaur 235.93 sq km. Agricultural activities may result in a decrease in soil organic carbon (SOC) in cultivated soils in comparison with their non-cultivated counterparts when losses are not sufficiently compensated by inputs. Tillage and the progressive replacement of organic amendments by inorganic fertilizers are among the processes that have contributed to the loss of soil organic matter (SOM) in cropped soils. Given the key role of organic matter in soil functions and agricultural sustainability, the maintenance of appropriate soil organic matter levels is essential to ensure soil quality and sustainability of soil use (Barral et al. 2009). Urban wastes and in particular municipal solid waste (MSW) are interesting sources of organic matter for agricultural soils now that urban areas are increasing at expenses of rural areas. Through composting, urban wastes can be transformed in safe soil amendments (Farrell and Jones 2009) that have been demonstrated to be of use in low-fertility, degraded or low-quality soils, where nutrient and organic matter inputs are necessary to restore productivity (Hargreaves et al. 2008; Park et al. 2011; Paradelo 2013; Rady et al. 2016). Notwithstanding, the problem with urban wastes is growing and compost use should be envisaged also for agricultural soils that do not necessarily need an increasing of fertility or organic matter content. In this case, potential negative effects of urban wastes, such as excess nutrient leaching or accumulation of potentially toxic elements, must be taken into account. When working with degraded systems, where soil fertility must be restored before any other consideration, these potential drawbacks can be considered a minor concern. In turn, if MSW composts are to be used in fertile soils with soil functions other than plant production in mind, environmental issues gain relevance. In this sense, the general objective of this work was to know what happens in very fertile and organic matter-rich soils: whether, in this case, the potential advantages of composts beyond plant yield have more weight than the associated risks.

Pesticides are considered to be indispensable for the production of a crop. Crop production is seriously affected by insect pests and diseases. Due to plant pests and diseases 20 to 40 percent of the crop yields are reduced globally (Agarwal et al., 2015 and Agarwal, S., 2000). To overcome these situations farmers are using pesticides as it is the most convenient and economical way to control the insect pests and diseases. The remaining residues of pesticides on harvested crops have a deleterious effect on humans and the environment. On the other hand, pesticides play a key role to control the insect pests and diseases. Cumin (*Cuminum cyminum* L.) commonly named as jeera is one of the prominent seed spice crops with good export potential and extensive domestic use (Spice Board of India, 2015). It is widely used as an organoleptic nutritional ingredient in food cuisines and savouries along with its inbuilt medicinal importance (Mathe, Akos, 2015). Cumin in particular is a high value seed spice which covers quite an area under cultivation in arid and semi-arid parts of Rajasthan and Gujarat. As evident, a variety of diseases and insect-pest are rampant on this crop during its cultivation such as wilt, blight, powdery mildew and insect infestation by aphids and thrips in moderate to severe form.

An array of fungicides and insecticides are used to control these diseases. Due to lack of education, the farmers of our country do not follow the prescribed dosages and use pesticides at any stage of the crop without any awareness of the residues and their ill effects on human health. Pesticide residues in these commodities if present beyond a prescribed limit (MRL) results in decline of produce quality hindering consumption at domestic and international level (Handa, et al., 1999; William et al., 2005 and Anonymous, 1993). To prevent serious pesticide residue issues following pre harvest interval (PHI) is the utmost requirement, so that the residue hazard can be controlled as well as the stakeholder can be suitably educated for opting scientifically developed and justified pesticide spray schedules preventing from higher residue in the harvested produce for better value to their produce and protecting health issues in the consumption chain. Pre harvest interval (PHI)/with-hold period (WHP) are harvesting restrictions that state when a crop can be harvested after a pesticide application. Research determines how long it takes for a pesticide to break down to below the maximum residue limit (Prodhan, 2018). This period is called the pre-harvest interval/with-hold period (WHP) or days-before-harvest for crops. To evaluate the efficacy and residue status for good quality cumin cultivation in the country, experimental trials for two years (2017- 2019) were conducted at ICAR-NRCSS, Ajmer farm with the pesticide molecules Dimethoate, Thiamethoxam, Acetamiprid, Mancozeb and Difenoconazole. India, 'the land of spices' enjoys a pre-eminent position in the worlds spice trade. Over 60 per cent of all spices are grown in India in almost every State and Union Territory. It is mostly cultivated in arid regions of Gujarat and Rajasthan state where agro climatic and edaphic conditions are most congenial to cumin cultivation. Average yield of cumin is 0.5 t/ha, which is quite low, and can be potentially increased to 0.7-0.8 t/ha by protecting the crop against pests and disease and by using improved varieties. Among various pests aphids [Myzuspersicae (Sulzer) and Hyadaphiscoriandri (Das)] has been reported as major pest of cumin. Aphid has been observed to attack 220 host plants belonging to 46 families throughout the world [1]. Owning to high rate of reproduction of this pest and continuous misshaping of the flower, the grain formation is very much reduced. In case of severally infested umbels, the seed not set at all or poorly developed. Secondly, they excrete honeydew like substance. The excessive excretion of honeydew by the aphids led to growth of black sooty mould on the leaves which inhibit the photosynthetic activity of the plants. Thus, it is posing a threat to cumin cultivation under Gujarat conditions. Lonely dependence on synthetic chemical for the control of aphid is very well known. In spite of regular occurrence of aphid in cumin growing regions, no any systemic work has been done on various aspects of such an important pest of cumin in Gujarat State. Keeping this in view, to overcome lacunae and to develop an effective pest management strategy, the present study was carried out with an objective of evaluation of the efficacy and economics of different insecticides against aphid on cumin grown in middle Gujarat. Cumin (*Cuminum cyminum* L., $2n = 2x = 14$) is an industrially important seed spices belonging to the family Apiaceae. This aromatic herbaceous plant is cultivated for drug and essential oil production and for extraction of important secondary metabolites (Heidari and Sadeghi, 2014; Bharti et al., 2018). Cumin is also used in beverages, liquors, toiletries and perfumery (Kumar et al., 2015). It has several beneficial medical characteristics such as reducing blood pressure and improving eyesight together with antimicrobial and anti-inflammatory effects (Konczak and Zhang, 2004; Walter et al., 2008; Alinian et al., 2016).

The market for herbal medicines and remedies is estimated to reach above $107 billion (Joshi and Shankar, 2015; Riasat et al., 2018; Varma and Shirivastava, 2018). Singh et al. (2017) reviewed the beneficial characteristics of cumin as an important herb and industrial species coming under the category of traditional spice in middle ages. Asia, Middle East and North Africa and specifically India and Iran have been identified as the largest producers and exporters of cumin seed and products (Lim, 2012; Bharti et al., 2018). Cumin cultivation area in Iran was around 0.04 million hectares in 2010 with an average seed yield of 500–1500 kg/ha in the rainfed and irrigated conditions, respectively (Ghasemi Pirbalouti, 2010). In Iran, the province Kerman is known as the most important center of cumin cultivation and diversity with significant contribution to economy of local farmers (Baghizadeh et al., 2013; Parashar et al., 2014). However, this region receives low annual precipitation and experiences periodic summer drought. Drought is one of the most important factors limiting the survival and growth of plants in arid and semi-arid regions. Cumin with short growth season of 100–120 days requires low supplemental irrigation (Kafi, 2002). This shows the need for better understanding the genetic basis of drought tolerance in cumin which is a prerequisite for development of superior genotypes through conventional and advanced breeding methods (Khaled et al., 2015). However, little information is available with respect to identification of genomic regions possessing important functions in tolerance or defence reactions against water limited conditions (Lee et al., 2011; Ebrahimi et al., 2017). Marker-assisted selection (MAS) is one of breeding tools whereby molecular markers are used for the indirect selection of drought tolerance (Collard et al., 2005). This method has been widely used in breeding crop plants to enhance disease resistance, quality traits and tolerance to biotic or abiotic stresses (Adams et al., 1991; He et al., 2014). The scope for genetic improvement of cumin is limited because information on genetic diversity and its intra specific relatedness is inadequate (Parashar et al., 2014).

Polymorphism in DNA markers are used for mapping quantitative traits loci (QTL), association analysis and dissecting genetic control of complex quantitative traits (Heidari et al., 2011, 2012; Tahmasebi et al., 2017; Varma and Shirivastava, 2018; Bharti et al., 2018). In linkage analysis, QTLs are typically localized at large intervals of 10 to 20 cM which is mainly due to limited number of recombination events occurred during the construction of mapping populations (Doerge, 2002; Holland, 2007). Alternatively, association analysis study can be used to test for association between DNA markers and QTLs when pedigree- based segregating populations are not available (Korir et al., 2013). Association analysis is a linkage disequilibrium-based (LD) method being used for estimation of the relationship between phenotypic and genotypic variations (Flint-Garcia et al., 2003). The goal of association analysis which is rely on marker-trait associations (MTAs) in diverse populations is to discern genomic regions that could either be markers, genes or QTL associated with traits for marker-assisted breeding, gene discovery or gene introgression (Edae et al., 2014; Mwadzingeni et al., 2017). Molecular breeding studies on cumin have been mainly limited to genetic diversity assessments and gene transformation but less-efforts have been devoted to mapping QTLs for agronomic traits in this species (Kermani et al., 2006; Pezhmanmehr et al., 2009; Rostami-Ahmadvand et al., 2013; Parashar et al., 2014). In Mortazavian et al. (2018), grain yield of cumin ecotypes was assessed and no molecular analysis was performed to validate genetic variation.

In another study, seed yield components and several morphological traits were evaluated in cumin and heritability and genetic variation parameters were estimated through biometrical genetics methods (Meena et al., 2016). Recently, Pandey et al. (2016) transformed cumin using *SbNHX1* gene, cloned from an extreme halophyte *Salicornia brachiate*, with the aim of enhancing salinity tolerance. Among DNA markers, the complementary DNA (cDNA)-amplified fragment length polymorphism (AFLP) is less labor-intensive mRNA fingerprinting method used for detection of differentially expressed genes and mapping QTLs (Baisakh et al., 2006). This method is a robust and high-throughput genome-wide expression tool for gene discovery, where prior knowledge of the sequences of a species is rare and not a prerequisite (Breyne and Zabeau, 2001). It is able to identify rare transcripts expressed in response to various treatments including biotic and abiotic stresses. Molecular characterization of the genotypes gives specific information about the extent of genetic polymorphism that helps in the development of cumin cultivar and a suitable breeding program (Parashar et al., 2014). Identification of accurate MTAs with low false positive rate depends on use of high power statistical analysis. The general linear model (GLM) and mixed linear model (MLM) methods have been widely applied for association analysis in crop plants (Dadras et al., 2014; Kumar et al., 2015; Ebrahimi et al., 2017). For cumin researchers willing to define and score a phenotype across many individuals, association analysis presents a powerful tool to reconnect a trait of interest back to its underlying genetics (Korte and Farlow, 2013).

To our knowledge, there is no report on association analysis of quantitative traits with respect to cDNA-AFLP in cumin (Parashar et al., 2014). As the first report of association analysis in cumin, the objectives of the present study were, (i) to investigate genetic variation of traits under normal irrigation and drought conditions, (ii) to dissect genetic structure of cumin populations through analysis of polymorphism in cDNA-AFLP fragments in a cumin and (iii) to identify reliable MTAs with respect to several important quantitative traits including seed yield for possible use in marker-assisted selection (MAS) practices in breeding for the improvement of drought tolerance in cumin.

LITERATURE REVIEW

Pesticides residues were estimated in some commonly used medicinal plants collected from different markets in Jeddah, Saudi Arabia, these are; (Rosemary; *Rosmarinus officinals* L. and Sage; *Salvia officinals* L.), family Lamiaceae, (Anise; *Pimpinella anisum* L., Caraway, *Carumcarvi L.* and Cumin; *Cuminum cyminum* L.) family Apiaceae, (Cinnamon; *Cinnamom umverum* L.) family Lauraceae, (Ginger; *Zingiber officinale* Roscoe) family Zingiberaceae and (Tea; *Camellia sinensis* L.) family Theaceae. It was found that Malathion, Pirimiphos-methyl and profenofos predominated in most all investigated samples while fungicides were detected only in Cumin and Caraway samples in the form of azole compounds. (Tebuconazole, propiconazole, flusilazole, difenoconazole) carbamate compounds (carbendazim) and other fungicides (iprodione, azoxystrobin, metalaxyl, flusilazole, thiophanate-methyl, ticyclazole, kresoxim-methyl and pendimethalin). Insecticides were dominated in Cumin, Caraway, Anise, Rosemary, Tea and Sage samples and mainly organophosphates (malathion, chlorpyrifos, profenofos, pirimiphos-methyl, ethion. The Ginger samples were free from pesticides while Cinnamon samples showed only the chloropyrifos LOQ But in Anise difenoconazole it was only in a huge amounts of medicinal plants are consumed in our daily life, in pharmaceutical industry and as crude herbs where they seemed to be safe products by consumers e.g.; Curcuma, Cayenne pepper, Ginger, Anis, Mint, Onions, Fenugreek, and Cumin enhance the synthesis of bile acids in the liver and their excretion in bile, what beneficially accelerate the digestion and absorption of lipids. Most of medicinal plants enhance the pancreatic and digestive enzymes of gastric mucosa (Lipase, Amylase and Protease). Also the extracts from medicinal plants and spices accelerate the digestion and decrease the time of feed/food passage through the digestive tract. Extracts of Curcuma, Red pepper, Black pepper, Cumin, cloves, Nutmeg, Cinnamon, Mint and Ginger showed anti -inflammatory effects in the rats. Many bioactive compounds of medicinal plants and spices play a vital role in the prevention of Lipid peroxidation. Generally medicinal plants are seemed to be miraculously treating many diseases and never looked at as a possible source of toxic substances. Residues of pesticide are found in all food items, vegetables, grains, fruits, eggs and fishes. Medicinal plants are liable to contain pesticides residues, which accumulate from Agriculture practice, treatment of soil during cultivation and administration of pesticides during storage of plants. Insect killer as DDT and its derivatives, g-HCH and other HCH isomers, HCB and cyclodiene derivatives such as aldrin, dieldrin, heptachlor and its epoxide were detected in crude herbal materials. other potentially contaminating pesticides includes organophosphates, carbamate Insecticides and herbicides, dithiocarbamate fungicides and triazine herbicides were also detected in the daily used medicinal plants. In addition polychlorinated biphenyls have been reported to occur in row herbal materials as a result of environmental pollution. According to the use of pesticides become a routine work in growing these plants in many countries and the level of using of these chemical materials is not very well authorized in developing countries and may have bad impacts and toxic effects in human health if it used without precautions and safety legally percentages. Accordingly this study was planned to investigate the levels of different pesticides residues in most common used medicinal plants and herbs collected from Jeddah, Saudi Arabia, with special references to their impacts on human health. The present study was undertaken to evaluate the efficacies and residue status at harvest for the pesticides Dimethoate, Thiamethoxam, Acetamiprid, Mancozeb and Difenoconazole in cumin crop during 2017-19. Supervised field trial was conducted and keeping in view the PHI, spraying with the requisite field dose of each pesticide was carried out @ 60, 90 & 105 DAS. The collected samples were analyzed using GC-MS-MS and LC-MS-MS for the pesticide residues status. The trend obtained for cumin yield (q ha-1) in the pooled data for different treatments during the years 2017-2019 was T2 > T6 > T5 > T1 > T3 >T4 and >T7 control thereby representing the efficacy of the various pesticide treatments. The residues status for the pesticides were below the prescribed MRL values with the spray at 60 and 90 DAS but spray @ 105 DAS resulted in higher MRL values for the pesticides dimethoate, thiamethoxam, acetamiprid and difenoconazole which ranged between 3.90–4.73; ~2.06 and ~2.19 and 1.84-2.04 ppm respectively. This indicates that pesticide use after 90 DAS should be strictly avoided to maintain the crop, residue free, its quality intact and thus promoting safe use and saA field experiment was conducted to study the bio-efficacy of different insecticides against cumin aphids [Myzuspersicae (Sulzer) and Hyadaphiscoriandri (Das)]. For the purpose, cumin [Gujarat Cumin 4 (GC-4)] crop was grown at Anand Agricultural University, Anand in first year one and second year two sprays were applied. First spray of insecticides was made at initiation of pest and second spray was given after 15 days.

Among the evaluated insecticides, flonicamid 50 WG 0.015 %, clothianidin 50 WDG 0.02 %, carbosulfan 25 EC 0.04% and thiacloprid 24 SC 0.024 % emerged out as the best treatments on the basis of efficacy against aphid, yield and economics. In this study Essential oils were used with cumin, cloves, cinnamon, laurel and anis to determine Minimum Inhibitory Concentration (MIC) against *Mycobacterium tuberculosis* strains. The MICs were determined on *M. tuberculosis* H37Rv sensitive to all five first line anti tuberculosis drugs (streptomycin, isoniazid, rifampicin, ethambutol and pirazinamide), two H37-Rv (CH-8 and CH-15) isoniazid-resistant, two H37Rv (CH-07 and CH-09) rifampicin-resistant, two H37Rv (CH-03 and CH-06) streptomycin-resistant, and two H37Rv (CH-09 and CH-10) ethambutol-resistant using the microplatealamar blue assay. The results obtained showed that the cumin and cinnamon essential oils showed a MIC of 12.5 µg/ml against reference strain H37Rv. The five essential oils used in this study were effective against the isoniazid-resistant variant of H37RV with MIC values in the range 12.5-100 µg/ml, the most potent being the cumin and cin-namon (MIC = 12.5). Similar results were obtained against rifampicin-resistant variant of H37RV with MIC values in the range 12.5-100 µg/ml; the most active ones in this case were the essential oils of cumin and cloves. The essential oils of anis and laurel were active with MIC value to 100 µg/ml. clove, cumin, and cinnamon essential oils were active against all strains utilized in this study, with MIC values in the range 6.25 µg/ml to 25 µg/ml. Cumin is one of the commonly used spices in food preparations. It is also used in traditional medicine as a stimulant, a carminative and an astringent. In this study, we characterized the antioxidant activity of three commercially available cumin varieties, viz., cumin (*Cuminum cyminum*), black cumin (*Nigella sativa*) and bitter cumin (C. nigrum). The antioxidant capacity of cumin varieties was tested on Fe2+ ascorbate induced rat liver microsomal lipid peroxidation, soybean lipoxygenase dependent lipid peroxidation and 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging methods. The total phenolic content of methanolic extracts of cumin varieties ranged from 4.1 to 53.6 mg g−1 dry weight. Methanolic extracts of all the three varieties of cumin showed higher antioxidant activity compared with that of the aqueous extract. Among the cumin varieties, bitter cumin showed the highest antioxidant activity followed by cumin and black cumin in different antioxidant systems. IC50 values of the methanolic extract of bitter cumin were found to be 0.32, 0.1 and 0.07 mg dry weight of cumin seeds on the lipoxygenase dependent lipid per oxidation system, the DPPH radical scavenging system and the rat liver microsomal lipid peroxidation system, respectively. The data also show that cumin is a potent antioxidant capable of scavenging hydroxy, peroxy and DPPH free radicals and thus inhibits radical-mediated lipid per oxidation. The high antioxidant activity of bitter cumin can be correlated to the high phenolic content among the three cumin varieties. Thus, bitter cumin with a high phenolic content and good antioxidant activity can be. Cumin is one of the commonly used spices in food preparations. It is also used in traditional medicine as a stimulant, a carminative and an astringent. In this study, we characterized the antioxidant activity of three commercially available cumin varieties, viz., cumin (*Cuminum cyminum*), black cumin (*Nigella sativa*) and bitter cumin (*C. nigrum*). The antioxidant capacity of cumin varieties was tested on Fe^{2+} ascorbate induced rat liver microsomal lipid per oxidation, soybean lipoxygenase dependent lipid peroxidation and 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging methods. The total phenolic content of methanolic extracts of cumin varieties ranged from 4.1 to 53.6 mg g^{-1} dry weight. Methanolic extracts of all the three varieties of cumin showed higher antioxidant activity compared with that of the aqueous extract.

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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)

RESEARCH METHODOLOGY

We used Gujarat Cumin-4 (GC-4) 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 cumin.

Binomial name – *Cuminum cyminum*

Seed details of used GC-4 Cumin Seed

Scientific classification	
Kingdom	Plantae
Clade	Tracheophytes
Clade	Angiosperms
Clade	Eudicots
Clade	Asterids
Order	Apiales
Family	Apiaceae
Genus:	*Cuminum*
Species:	***C. cyminum***

Shelf Life	1 Year
Variety	GC-4
Seed Class	TFL
Packaging Type Available	Packet
Packaging Size Available	2 kg
Price	Rs 350/kg (2kg-700/kg)
Color	Brown

PERSONAL PROTECTIVE APPARATUS: Gloves, Long Sleeves, Boots and Mask etc.
Tools: These tools were used in soil sampling
Khurpi, Auger, Spade, Pen- Paper, Sieve, Plastic Bag, Banner and Board etc.

METHODOLOGY OF SEED TREATMENT IN CUMIN PLOTS

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

METHODOLOGY OF SOIL TREATMENT IN CUMIN PLOTS

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

SEED WEIGHT and SPRAY: Seed variety GC-4 was weighed by weighing balance. After that the seeds showered by hand in each plot.

CHEMICALS and BIO AGENTS: These were weighed by weighing balance. After that the pesticides and bio-fertilizer sprayed by sprayer in each plot.

SEED GERMINATION and 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.

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

RECORDING OF READINGS OF SEED GERMINATION (%) OF CUMIN CROP AFTER 20 DAYS OF SOWING IN EIGHT VILLAGES AT NAGAUR REGION

S. No.	Village	P-1	P-2	P-3	P-4
1	Inana	66%	85%	70%	90%
2	Kuchera	45%	61%	58%	78%
3	Gaju	70%	86%	75%	95%
4	Chhilra	68%	83%	73%	93%
5	Balaya	76%	90%	86%	98%
6	Parashara	73%	88%	81%	96%
7	Silariya	55%	75%	68%	81%
8	Dehroli	50%	71%	63%	80%

YIELD SEED WEIGHT

YSW = Total weight - Straw weight.

Total Weight = Straw weight + Seed weight

DATA ANALYSIS

1.Plant Height	**P-1**	**P-2**	**P-3**	**P-4**
Maxi. Value.	Balaya (15-32cm)	Balaya (20-38cm)	Balaya (18-35cm)	Balaya (22-40cm)
Mini. Value.	Kuchera (12-20cm)	Kuchera (15-24cm)	Kuchera (15-21cm)	Kuchera (15-30cm)
2. No. of Plants	**P-1**	**P-2**	**P-3**	**P-4**
Maxi. No.	Balaya (36)	Balaya (48)	Balaya (43)	Balaya (51)
Mini. No.	Kuchera (18)	Kuchera (28)	Kuchera (23)	Kuchera (35)
3. No. of Branches	**P-1**	**P-2**	**P-3**	**P-4**
Maxi. No.	Balaya (6-10)	Balaya (10-15)	Balaya (8-12)	Balaya (10-18)
Mini. No.	Chhilra (5-7)	Chhilra (8-11)	Chhilra (7-10)	Chhilra (8-13)

4.No. of Spikes	**P-1**	**P-2**	**P-3**	**P-4**
Maxi. No.	Balaya (26-32)	Balaya (40-52)	Balaya (35-41)	Balaya (42-55)
Mini. No.	Chhilra (18-25)	Chhilra (33-38)	Chhilra (24-29)	Chhilra (38-41)
5. Root Height	**P-1**	**P-2**	**P-3**	**P-4**
Maxi. No.	Balaya (6-8cm)	Balaya (9-12cm)	Balaya (8-10cm)	Balaya (10-15cm)
Mini. No.	Chhilra (5-7cm)	Chhilra (6-8cm)	Chhilra (5-8cm)	Chhilra (8-10cm)
6. Root Branches	**P-1**	**P-2**	**P-3**	**P-4**
Maxi. No.	Balaya (7-10)	Balaya (10-12)	Balaya (8-11)	Balaya (12-15)
Mini. No.	Silariya (4-6)	Silariya (7-9)	Silariya (6-8)	Silariya (7-10)
7. Umbel/ Plant	**P-1**	**P-2**	**P-3**	**P-4**
Maxi. No.	Balaya (36-48)	Balaya (70-80)	Balaya (54-66)	Balaya (78-90)
Mini. No.	Silariya (18-22)	Silariya (30-32)	Silariya (26-29)	Silariya (30-35)
8. Seed/ Umbel	**P-1**	**P-2**	**P-3**	**P-4**
Maxi. No.	Balaya (35-48)	Balaya (40-47)	Balaya (40-45)	Balaya (41-47)
Mini. No.	Dehroli (12-18)	Dehroli (20-33)	Dehroli (17-23)	Dehroli (20-35)
9. Seed Germi.	**P-1**	**P-2**	**P-3**	**P-4**
Maxi. %.	Balaya (76%)	Balaya (90%)	Balaya (86%)	Balaya (98%)
Mini. %.	Kuchera (45%)	Kuchera (61%)	Kuchera (58%)	Kuchera (78%)
10 Seed Weight	**P-1**	**P-2**	**P-3**	**P-4**
Maxi. Value.	Balaya (59.50gm)	Balaya (93gm)	Balaya (77.50gm)	Balaya (110gm)
Mini. Value.	Dehroli (50gm)	Dehroli (80gm)	Dehroli (62.5gm)	Dehroli (96.5gm)
11. Total Profit (Rs/hac)	**P-1**	**P-2**	**P-3**	**P-4**
Maxi. Profit.	Balaya (86,275)	Balaya (134,850)	Balaya (112,375)	Balaya (159,500)
Mini. Profit.	Dehroli (72,500)	Dehroli (116,000)	Dehroli (90,625)	Dehroli (139,925)
12. Total Net Profit(Rs/ha)	**P-1**	**P-2**	**P-3**	**P-4**
Maxi. Net Profit.	Balaya (55,150)	Balaya (101,125)	Balaya (79,450)	Balaya (124,975)
Mini. Net Profit.	Dehroli (41,375)	Dehroli (82,275)	Dehroli (57,700)	Dehroli (100,400)

13. Benefit : Cost	P-1	P-2	P-3	P-4
Maxi. Value.	Balaya (2.77)	Balaya (3.99)	Balaya (3.41)	Balaya (4.61)
Mini. Value.	Dehroli (2.32)	Dehroli (3.43)	Dehroli (2.75)	Dehroli (3.90)

TOTAL PRODUCTION AND PROFIT COST RATIO

Village Name	No. of Plots	Total Production (quintal/ha)	Profit Cost Ratio
1) Inana	P-1	5.75	2.67
	P-2	8.90	3.82
	P-3	7.37	3.24
	P-4	10.62	4.46
2) **Kuchera**	P-1	5.50	2.56
	P-2	8.62	3.70
	P-3	6.87	3.02
	P-4	10.30	4.32
3) **Gaju**	P-1	5.65	2.63
	P-2	8.75	3.76
	P-3	7.00	3.08
	P-4	10.50	4.40
4) **Chhilra**	P-1	5.35	2.49
	P-2	8.45	3.63
	P-3	6.60	2.90
	P-4	10.00	4.19
5) **Balaya**	P-1	5.95	2.77
	P-2	9.30	3.99
	P-3	7.75	3.41
	P-4	11.00	4.61
6) **Parashara**	P-1	5.87	2.73
	P-2	9.20	3.95
	P-3	7.50	3.30
	P-4	10.90	4.57
7) **Silariya**	P-1	5.20	2.42
	P-2	8.12	3.49
	P-3	6.50	2.86
	P-4	9.75	4.09
8) **Dehroli**	P-1	5.00	2.32
	P-2	8.00	3.43
	P-3	6.25	2.75
	P-4	9.65	3.90

MEAN AND STANDARD DEVIATION VALUE OF CUMIN PARAMETERS (TOTAL PRODUCTION AND PROFIT COST RATIO)

Parameters	No. of Plot	Mean	SD
Total Production	P-1	5.53	0.3114
	P-2	8.66	0.3962
	P-3	6.98	0.5356
	P-4	10.34	0.4580
Profit : Cost	P-1	3.43	0.8685
	P-2	3.72	0.1878
	P-3	3.07	0.2167
	P-4	4.31	0.2054

EFFECT OF PESTICIDES ON CUMIN CULTIVATION

We used an optimum amount of pesticides in my research work so that the plant remains disease free. The use of pesticide increased crop production and yielded more in less land. The use of pesticide reduced the problem of weeds in the crop. During the seed treatment, the seeds were treated with pesticides, which caused the seed to be free of bacteria and fungal and the percentage of seed germination was also good. The crop was able to grow well even in adverse conditions, due to which the crop was obtained at aoptimum time. It effectively controls soil borne pathogens causing wilt disease and root rot disease in the crop. The possibility of waterborne diseases and insect-transmitted diseases was less with the use of pesticides in the crop. The new seeds were of good quality, large in size and healthy. Due to this, they were stored for the next season. Soil quality and Soil fertility were less affected by the use of an optimum amount of pesticide.

CONCLUSION

Out of all these eight villages, cumin plant height was the maximum in all four plots P-1,P-2,P-3 and P-4 of Balaya village (40cm), while cumin plant height was the minimum in all four plots of Kuchera village (30cm). It happened because the soil of Balaya village is the most sandy, soft and free of large soil particles and the soil of Kuchera village is very hard, saddle and containing large soil particles. The maximum no. of plants was found in the four plots of Balaya village (51), while the minimum no. of plants was found in all four plots of Kuchera village (35). The maximum no. of braches (18) and spikes (55) were found in the four plots of Balaya village, while the minimum no. of branches (13) and spikes (41) were found in all four plots of Chhilra village. The maximum root height was found in the four plots of Balayavillage (15cm), while the minimum root height was found in all four plots of Chhlira village (10cm). The maximum no. of root braches was found in the four plots of Balaya village (15), while the minimum no. of root branches was found in all four plots of Silariya village (10). The maximum no. of umbels per plant was found in the four plots of Balaya village (90), while the minimum no. of umbels per plant was found in all four plots of Silariya village (35). The maximum no. of seeds per umbel was found in the four plots of Balaya village (47), while the minimum no. of seeds per umbel was found in all four plots of Dehroli village (35). The maximum Seed weight was found in the four plots of Balaya village (110gm), while the minimum seed weight was found in Dehroli village (96.5gm).The maximum seed germination % was found in the four plots of Balaya village (98%), while the minimum seed germination was found in Kuchera village (78%). The maximum Total Production (yield) was found in the four plots of Balayavillage (11q/hac), while the minimum total production was found in Dehroli village (9.65q/hac). The maximum Total Profit was found in the four plots of Balayavillage (1,59,500 Rs/hac), while the minimum total profit was found in Dehroli village (1,39,925 Rs/hac). The maximum Total Net Profit was found in the four plots of Balaya village (1,24,975 Rs/hac), while the minimum total net profit was found in Dehroli village (1,00,400 Rs/hac). The maximum Profit – Cost Ratio was found in the four plots of Balaya village (4.61), while the minimum profit-cost ratio was found in Dehroli village (3.90). Out of the four plots in all the villages the growth parameters, yield parameters and economical parameters of the P-4 plot were found to be good quantity and quality while the above parameters were found to be low quantity in the P-1 plot. I used chlorinated pesticides (Ampligo and Tubeconazole) in optimum quantity in eight selected villages, due to which the problem of weeds was less in our research area and farmers used non- chlorinated pesticides (Kuchera – Stamp) due to which weed problem was more in their fields. Plants remain disease free and healthy by using chlorinated pesticide in our research area and plants were found to be diseased even after using non- chlorinated pesticide (Silariya and Dehroli Village – Monocrotophos) by farmers. The use of chlorinated pesticide in the research plot gave good production and even after using non- chlorinated pesticide (Kuchera –Stamp and Dehroli – Monocrotophos) by the farmers, they got the production less than the prescribed quantity. I used chlorinated pesticide, due to which the height and number of plants and plant growth were good in the research plot, whereas these growth parameters were found to be less than normal in the farmers field (Chhilra – Mancozeb 45). I used chlorinated pesticide (Ampligo) for the treatment of seeds in research work, due to which we got good percentage of seed germination and good quality seeds, whereas the percentage of seeds germination was less than due to non- treatment of seeds by the farmers. I used chlorinated pesticide in research area, due to which good crop was obtained in less land and in reasonable time whereas farmers used non- chlorinated pesticide but they took more time to get the crop.

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