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Contents

INTEGRATED MANAGEMENT OF WILT OF CHICKPEA INCITED BY *FUSARIUM OXYSPORUM* F. SP. *CICERIS*

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Abstract: Bacterial and fungal bioagents were isolated from soil sample collected from rhizosphere of healthy chickpea plant in a wilt affected field. In dual culture studies among 11 fungal isolates CPF-1was found most effective with 88.60 per cent of inhibition and among the 24 bacterial isolates, CPB-10 showed 87.34 per cent inhibition of mycelia growth of *Fusarium oxysporum* f. sp. *ciceris*. By studying morphological and cultural characters CPF-1 was identified as *Trichoderma viridae* and CPB-10 as *Pseudomonas fluorescence*. Among different fungicides evaluated mancozeb was found compatible with both CPB-10 and CPF-1. CPB-10 and CPF-1 were also found compatible among themselves.The potential bacterial bioagent (CPB-10) and potential fungal bioagent (CPF-1), compatible fungicide mancozeb (0.2%), neem cake, vermicompost and farm yard manure was selected for integrated management of *Fusarium oxysporum* f. sp. *ciceris* under pot culture. Among the fifteen treatments imposed, treatment T12 (soil application of biocontrol agents + soil application of neem cake) was found to be superior as it recorded the least PDI of 20.46 per cent, Maximum shoot length (24.60 cm), Maximum root length (8.82cm), maximum shoot dry weight (0.30 g) and Maximum root dry weight (0.09g).

Keywords: Antagonists, Fungicidal compatible, *Fusrium oxysporum* f. sp. *Ciceris*, Integrated disease management

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is one of the major grain legume pulse crops of India. In India it is grown over 10.22 million ha with an annual production and productivity of 9.53 million tonnes and 967 kg ha^{-1}. In Andhra Pradesh, it is grown over an area of 5.86 million ha with an annual production and productivity of 8.43 million tonnes and 1298 kg ha^{-1} respectively (Indiastat.com. 2013-2014). Although chickpea is predominantly consumed as a pulse, dry chickpea is also used in preparing a variety of snack foods, sweets and condiments and green fresh chickpeas are commonly consumed as a vegetable. Chickpea also maintain soil fertility through biological nitrogen fixation in soil and thus play a vital role in enhancing sustainable agriculture. Many diseases occur at different growth stages in chickpea, among them wilt caused by *Fusarium oxysporum* f. sp. *ciceris* is one of the important diseases with yield loss over 60 per cent (Singh *et al.*, 2007). *Fusarium oxysporum* f. sp. *ciceris* is soil borne plant pathogen and is difficult to manage the disease by application of fungicides. Moreover, the chemical control is costly and leads to residual effect. In the present study integration of chemical fungicides with bacterial and fungal biocontrol agents, along with organic manures *viz.*, neem cake, vermicompost and farm yard manure were contemplated.

MATERIAL AND METHOD

The present investigation was carried out in the department of Plant Pathology, S.V. Agricultural College, Tirupati, which is located at 13.65 º N, 79.42º E and 874 mts. (2820 ft) above sea level and it lies at the foot of the Seshachalam hills.

The efficacy of potential biocontrol agents, compatible fungicide, farm yard manure, neem cake and vermicompost were evaluated under glass house conditions against the pathogen on popularly cultivated chickpea variety JG-11 by imposing the following treatments:

Treatment No.	Treatment
T_1	Seed treatment with potential fungal biocontrol agent @ 10g kg^{-1}
T_2	Seed treatment with potential bacterial biocontrol agent @ 10g kg^{-1}
T_3	Seed treatment with both potential fungal and bacterial antagonists
T_4	Seed treatment with fungicide @ 2-4 g/kg seed
T_5	Soil application of fungal biocontrol agent*
T_6	Soil application of bacterial biocontrol agent*
T_7	T5 + T6
T_8	Seed treatment with T4 + T5 + T6
T_9	Soil application of Neem cake @12.5 q ha^{-1}
T_{10}	Soil application of FYM @5t/ha
T_{11}	Soil application of Vermicompost @5 q ha^{-1}

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T_{12}	Soil application of potential fungal and bacterial biocontrol agents + T9
T_{13}	Soil application of potential fungal and bacterial biocontrol agents + T10
T_{14}	Soil application of potential fungal and bacterial biocontrol agents + T11
T_{15}	Treated control

Variety: JG-11; Design: CRD; Replications: 3

* The potential fungicidal tolerant antagonists in talc based formulation will be multiplied on FYM, and 100 g of FYM/pot (25 cm diameter) will be applied before sowing.

Mass multiplication of *Fusarium oxysporum* f. sp. *ciceris*

The test pathogen *Fusarium oxysporum* f. sp. *ciceris* was mass multiplied on sterilized sorghum seeds for pot culture studies. For this, 100g of sorghum seeds were washed thoroughly in tap water and soaked in water for overnight in 250 ml conical flask with addition of 20 ml of 4 per cent dextrose. After removing the water, the flasks with soaked sorghum seeds were autoclaved for 20 min at 15 p.s.i and inoculated with 2-3 discs of size 5 mm diameter from 4 days old culture of test pathogen and incubated at 25 ± 2°C After seven days the inoculum was mixed with sterilized soil in pots @100 g kg^{-1}.

Preparation of talc based formulation of potential bacterial isolate and fungal isolate

The talc based formulation of potential bacterial and fungal biocontrol agent was prepared by following the method as described by Vidhyasekharan and Muthamilan (1995). A loopful of potential antagonistic bacteria was inoculated into Nutrient broth and incubated in a rotary shaker at 150 rpm for 48 hours at room temperature (28 ± 2°C). pH was adjusted to 7.0 by adding $CaCo_3$ at the rate of 15 g per kilogram of talc. 10 g of carboxy methyl cellulose (CMC) was added to 1 kg of talc powder, mixed well and the mixture was autoclaved for 30 min. at 121°C for 2 successive days. 400 ml of the bacterial suspension containing $1x10^8$ cfu/ml was mixed under aseptic conditions and unified. After drying to 35 per cent moisture content overnight under aseptic conditions, the mixture was packed in polypropylene bags and sealed.

Talc based formulation of fungal antagonist was prepared as follows: potato dextrose broth was inoculated with 2 to 3 discs of four days old culture of potential *Trichoderma* spp. in conical flasks and incubated at 25 ± 2ºC for seven days. Then *Trichoderma* culture biomass along with medium was mixed with talc powder in the ratio of 1:2 (1 litre of *Trichoderma* culture biomass and 2 kg of talc powder). After thorough mixing the talc formulation was shade dried for 3-4 days under aseptic conditions and to that stickering agent carboxy methyl cellulose (CMC) was added @ 15g per kg and the mixture was unified. The mixture was packed in polypropylene bags, sealed and stored at cool dry conditions.

Seed treatment

Chickpea seeds were treated with talc based formulation of potential biocontrol agent @ 10g per kg of seed and the seeds were used for sowing. For treatment with fungicide, the chickpea seeds were treated with compatible and effective fungicide @ 2-4 g/kg seed and sown in the pathogen infested soil in the pots. For treatment with both potential biocontrol agent and fungicide, at first seeds were treated with biocontrol agent followed by compatible fungicide.

Soil application

The potential biocontrol agent was multiplied in Farm Yard Manure (FYM) and 100 g of FYM/pot was applied before sowing. For application of fungicide to the soil, soil was drenched with 0.2 per cent fungicide (mancozeb) solution @ 250 ml per pot as reported by Ayyub (2001).

Observations

i. Percentage of disease incidence (PDI)

$$PDI = \frac{\text{Number of diseased plants}}{\text{Total number of plants}} \times 100$$

ii. Shoot and root length

The average shoot and root length of the plants was recorded.

iii. Dry weight of shoots and roots

The samples were allowed to dry at 60ºC temperature in hot air oven for 24 hours and the dry weights of shoots and roots were recorded.

Statistical analysis

Wherever necessary, the data was statistically analyzed (Gomez and Gomez, 1984). Completely Randomized Design (CRD) was used for pot culture experiment, dual culture technique, poisoned food technique and the treatments were compared at $P \leq 0.05$.

RESULT AND DISCUSSION

Per cent disease incidence

From the data (Table: 1) it is evident that all the treatments were significantly superior over control in reducing the per cent disease incidence. Maximum reduction was observed in treatment T_{12} (soil application with potential biocontrol agents + soil application of neem cake) in which PDI of 20.46 per cent was recorded when compared to treatment T_{15} inoculated control (92.89%).

Effect of different treatments on plant growth parameters

Shoot length

Maximum shoot length (24.60 cm) was recorded in treatment T_{12} (soil application with potential biocontrol agents + soil application of neem cake) followed by T_{14} (soil application with potential biocontrol agents + soil application of FYM) and T_{13} (soil application with potential biocontrol agents + soil application of vermicompost). It is evident from the data that least plant height (17.50 cm) was recorded in inoculated control (T_{15}).

It is evident from results that treatment T_{12} stimulated the plant growth and development when compared to other treatments.

Root length

Maximum root length was recorded in treatment T_{12} (8.82cm) followed by treatment T_{14} (8.56 cm) and T_{13} (8.42 cm). The data revealed that least root length (5.60 cm) was recorded in inoculated control (T_{15}).

Dry weight of shoot and root

The maximum shoot dry weight was recorded in treatment T_{12} (0.30 g) followed by treatment T_{13} (0.24 g) and T_{14} (0.23 g). It is evident from the data that the least shoot weight (0.19 g) was recorded in inoculated control (T_{15}).

Maximum root dry weight (0.09g) was recorded in treatment T_{12}, T_{14} and T_{13} and least (0.06 g) was recorded in inoculated control (T_{15}).

CONCLUSION

From the above results it is evident that treatment T_{12}. Thus overall, the efficacy of treatment T_{12} (soil application with potential biocontrol agents + soil application of neem cake) was found to be superior which recorded least PDI when compared to other treatments.

Least PDI, maximum shoot length, maximum root length and maximum shoot and root dry weight were recorded in T_{12} due to the combined effect of bacterial, fungal biocontrol agent and neem cake.

Efficacy of treatments imposed in integrated disease management on percent incidence of wilt of chickpea in pot culture

Treatment No.	*Per cent disease incidence	Shoot length (cm)	Root length (cm)	Dry weight (g)	
				Shoot	Root
T_1	80.43 (63.72)	20.96	6.66	0.14	0.07
T_2	80.25 (63.58)	20.85	6.52	0.12	0.07
T_3	60.14 (50.83)	21.68	6.89	0.16	0.07
T_4	70.86 (57.29)	21.89	6.97	0.18	0.07
T_5	80.45 (63.72)	20.65	6.52	0.15	0.07
T_6	90.26 (71.76)	20.57	6.36	0.17	0.07
T_7	70.76 (57.23)	21.98	7.02	0.19	0.07
T_8	60.12 (50.83)	22.54	7.29	0.20	0.08
T_9	60.53 (51.06)	22.84	7.59	0.22	0.08
T_{10}	60.43 (51.00)	22.65	7.34	0.21	0.08

T_{11}	70.68 (57.17)	22.48	7.36	0.20	0.08
T_{12}	**20.46 (26.85)**	**24.60**	**8.82**	**0.30**	**0.09**
T_{13}	40.88 (39.70)	23.25	8.42	0.23	0.09
T_{14}	50.68 (45.34)	23.49	8.56	0.24	0.09
T_{15}	92.89 (74.44)	17.50	5.60	0.11	0.06
S.Em (±)	2.040	2.281	0.760	0.058	0.014
C.D (0.05)	5.921	1.326	1.206	0.020	0.000

*Mean of three replications
Figures in parenthesis are angular transformed values

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EVALUATION OF DIFFERENT INSECTICIDE FORMULATIONS AGAINST *APHIS GOSSYPII* IN OKRA CROP

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Abstract: Evaluation of insecticides against sucking pest like aphid in okra crop was conducted Department of Entomology, CoA, IGKV, Raipur during *Rabi*2013-14. During *first of spraying*, the lowest aphid population was recorded (4.91/plant) against treatment $T_6$and highest in T_1 (9.41/plant) within fifteen day of spraying. Whereas, the aphid population was also exhibited lowest (5.92/plant) in $T_6$and treatment T_1 observed highest (9.77/plant) during *second of spraying*. The mean of first and second of spraying theaphid population (5.42 aphid/ plant) was observed minimum in foliar application of treatment T_6 i.e. spinosad 45EC @75g a.i./ ha followed by treatment T_4 i.e.emamectin benzoate 5 SG@13 g a.i./ha(6.46aphid/ plant).The maximum 9.60 aphid/ plant was recorded in treatment T_1i.e. emamectin benzoate 5 SG@8 g a.i./ha. Thus, during this period spinosad 45EC was found to be best effective treatment and which minimized the aphid populationwhileemamectin benzoate 5 SG@8 g a.i./ha was noticed the least effective as compared to among all treatments.

Keywords: Evaluation of insecticides, Okra aphid, *Aphis gossypii*, Sucking pest of okra

INTRODUCTION

Okra is ravaged by as many as 45 species of insect-pests throughout its growth period (Rawat and Sahu, 1973). Among these, the aphid, *Aphis gossypii* is a polyphagous sucking pest and also found damaging okra all over India. It also acts as vector of virus and transmits mosaic, leaf curl etc. (Butani and Verma, 1976). The indiscriminate use of pesticides has caused toxicity to non-target beneficial organisms resulting in development of pest resistance to the chemical pesticides and resurgence of pest due to pyrethroids (Basha *et al.,* 1982). A field experiment conducted at Bangalore (Karnataka) by Mohan and Mohan (1985) revealed that endosulfan (0.7 kg a.i. ha-1) was quite effective for the suppression of A. biguttula biguttula and *A. gossypii* population on okra crop. Rai (1985) revealed from field trials conducted at New Delhi on management of okra pests that decamethrin (0.0065%) gave maximum reduction in jassid population but was statistically at par with cypermethrin at both the doses (0.017%; 0.00325%), whereas, chlorpyriphos (0.048%) was the most effective against aphids but did not differ statistically from cypermethrin (0.034%) and decamethrin (0.0065%). Cypermethrin (100 g a.i. ha-1) gave good protection to okra against aphids and jassids at Bhubneshwar, Orissa compared to thiomethoxam and imidacloprid (both at 25g a. i. ha-1) which were less effective (Mishra, 2002). Patel *et al*. (1997b) conducted field experiments on okra at Anand (Gujarat) to test the efficacy of some conventional insecticides against *A. gossypii* and *A. biguttula biguttula*. They reported that among the different insecticidal sprays, endosulfan (0.035%) was most effective against both the pests. In West Bengal, higher mortality of aphids (66.19%) and jassids (49.52%) on okra crop was brought about by the application of malathion (Ghosh *et al.,* 1999). Rao *et al.* (1991) reported from Bapatla (Andhra Pradesh) that 4 sprays of endosulfan (0.07%) or endosulfan (0.07%) alternated with carbaryl (0.15%) were quite effective against aphids and leafhoppers infesting okra crop.

MATERIAL AND METHOD

Field experiment was undertaken for two spraying during *Rabi*, 2013 - 14 in a randomized block design with seventh treatments replicated three times at experimental field of Entomology, IGKV, Raipur. The insecticidal treatments included Emamectin benzoate 5 SG of four doses *viz.* 8.0, 10.0, 11.0 & 13.0 gm a.i.ha^{-1}, respectively and 50.0 gm a.i./ha of Cypermethrin 10EC and 75.0 gm a.i./ha of Spinosad 45 ECalong with an untreated control.Rice variety 'Swarna' was grown in plot of size 4m × $6m^2$ at spacing of 10cm × 15cm with recommended package of practices excluding plant protection. The insecticides were sprayed by high volume knapsack sprayer using 500 litres of spray fluid per hectare. Sprayer was calibrated for equal discharge of insecticidal solution in all the treatments. The control plots were sprayed with water only. Observations were taken on the number of aphid population/plant from ten randomly and diagonally taken plant of each plot leaving the border rows at one day before spraying and 1, 3, 5, 7, 10 and 15 days after sprayings. Data recorded before and after the sprayings are pooled, transformed, analyzed and presented in the Table- 1, 2&3 and Fig.-1&2.

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RESULT AND DISCUSSION

The non-significant difference observed in different plots during the pretreatment observation. The post treatment, in first spraying, at one DAS, the minimum aphid population(3.22 aphid/ plant) was observed in foliar application of cypermethrin 10EC @ 50 g a.i./ hafollowed by treatment (T_3) Emamectin benzoate 5 SG@8 g a.i./ha(5.55aphid/ plant).The maximum 8.65aphid/ plant was recorded in treatment (T_1) Emamectin benzoate 5 SG@8 g a.i./ha. Whereas, in second spraying, the minimum aphid population(3.42 aphid/ plant) was noticed in cypermethrin 10EC @ 50 g a.i./ha followed by treatment (T_4) Emamectin benzoate 5SG@13 g a.i./ha(7.85aphid/ plant) and maximum aphid population (8.25aphid/ plant)was recorded in treatment (T_1) Emamectin benzoate SG@8 g a.i./ha. In three days after spraying of insecticides the minimum aphid population per plant was observed in foliar application of (T_6) Spinosad 45 EC@75g a.i./ha (4.32 aphid/ plant) and maximum in Emamectin benzoate 5SG@8 g a.i./ha(8.78 aphid/ plant) in after first spraying. Whereas, in after second spraying there was minimum aphid population was observed in of cypermethrin 10EC@50 g a.i./ ha,(3.89 aphid/ plant) and maximum in Emamectin benzoate 8 SG@11 g a.i./ha(8.56aphid/ plant). In five days, after application of insecticides, the treatment six (T_6) Spinosad 45 EC@75g a.i./ha recorded the least aphid population(4.32 and 4.22aphid/ plant). The treatment (T_3) Emamectin benzoate 5%SG@11 g a.i./ha, and treatment four (T_4) Emamectin benzoate 5%SG@13 g a.i./ha were found statistically at par. There was maximum aphid population observed in Emamectin benzoate 5%SG@8 g a.i./ha, i.e. treatment seven (T_1) 8.78 and 8.56 aphid per plant after first and second of spraying, respectively.Seven days after spraying of insecticides, the minimum aphid population was recorded in treatment six (T_6) spinosad 45EC@75g a.i./ha (4.19 and 4.34aphid/ plant).The treatment four (T_4) Emamectin benzoate 5%SG@8 g a.i./ha was found maximum (9.77 and 9.36 aphid/ plant) in after first and second of spraying. The entire treated plot had statistically highly significant lower population as compared to control.In tenth days after application of insecticides treatment six (T_6) Spinosad 45 EC@75g a.i./ha had minimum aphid population(5.45 and 5.41aphid/ plant). There was maximum aphid population observed in Emamectin benzoate 5%SG@8 g a.i./ha, i.e. treatment seven (T_1) 10.01and11.32 aphid per plant after first and second of spraying, respectively.In fifteenth days after application of insecticides, the treatment six (T_6) spinosad 45EC @75g a.i./ ha (7.05 and 7.31 aphid/ plant) showed the best effect and treatment T_4,T_3,T_5 were found statistically at par after first and second spraying, respectively.

During *first spraying* 2013-14, the lowest aphid population was recorded 4.91/plant against treatment $T_6$and highest in T_1 (9.41/plant) within fifteen day of spraying Whereas, the aphid population was also exhibited lowest 5.92 per plant in $T_6$and treatment T_1 observed highest (9.77/hill)during *second spraying* 2013-14was significantly low as compared to control.

Pooled mean of first and second spraying of insecticides was reduced the population of aphid in okra ranged from 5.42-9.60within 15 days after spraying. The differences between treatments in respect of aphid population were found significantly superior over the untreated control. The minimum aphid population(5.42 aphid/ plant) was observed in foliar application of treatment (T_6) spinosad 45EC @75g a.i./ ha followed by treatment (T_4) Emamectin benzoate 5 SG@13 g a.i./ha(6.46aphid/ plant).The maximum 9.60 aphid/ plant was recorded in treatment (T_1) Emamectin benzoate 5 SG@8 g a.i./ha. Thus, during this period spinosad 45EC was found to be the best effective treatment and minimized the aphid population, whereas Emamectin benzoate 5 SG when dose applied @8 g a.i./ha was recorded the least effective treatment.The effectiveness of *V.lecanii and C.zastrowisillemi* in controlling aphids has been reported by Khalil *et al.* (1983), Yokomi and Gottwald (1998), Ramarethinam*et al.* (2005) and Nirmala*et al.*,(2006) earlier and the present study also confirmedtheir findings.The efficacy of spinosad in reducing the aphid population has been documented by Stansly (2001) who observed that spinosad gave effective control of aphids in cotton ecosystem.

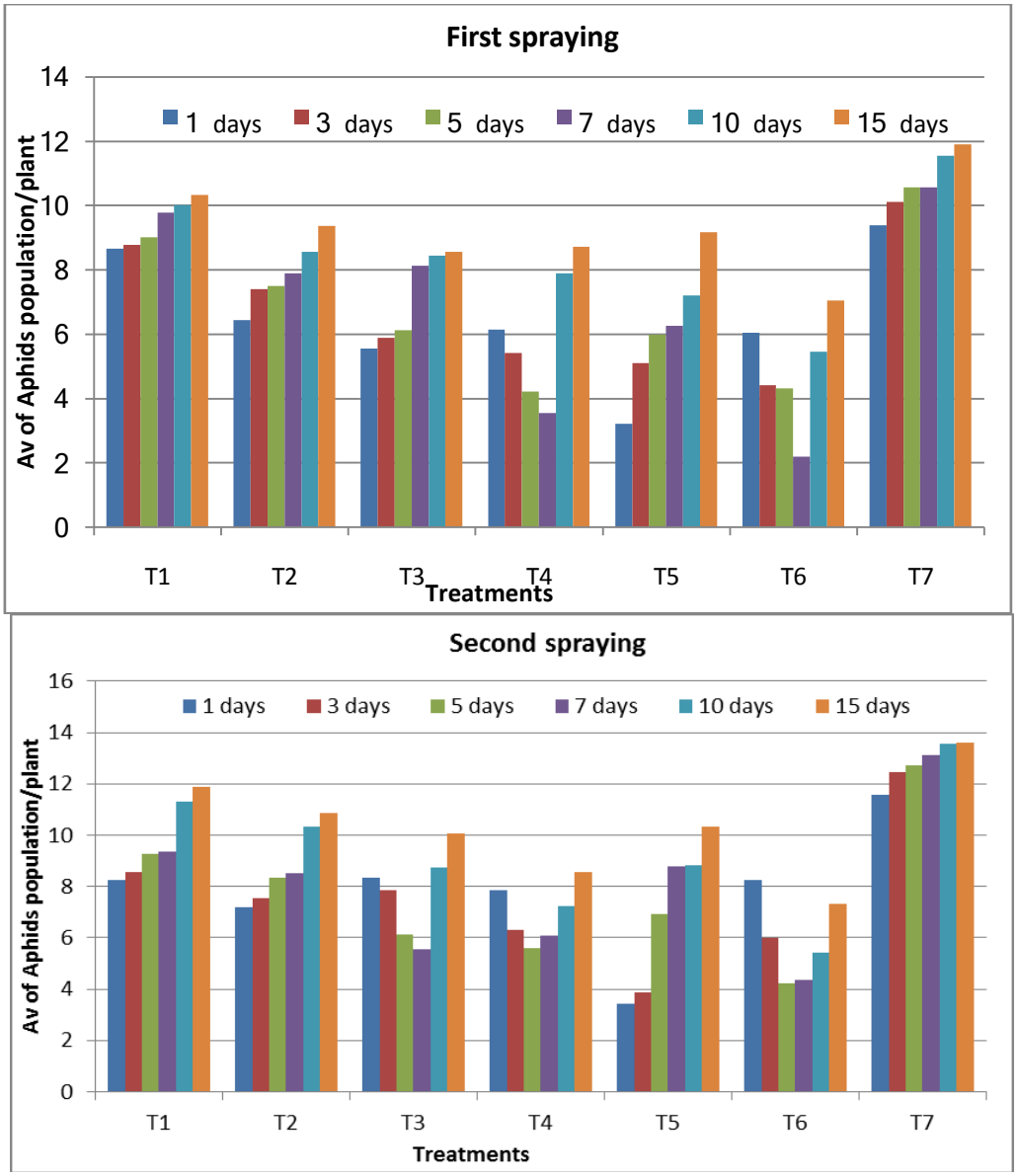

Fig.-1: Bioefficacy of different insecticides against aphid population / plant on okra crop after first and second sprayed during *Rabi* 2013-14

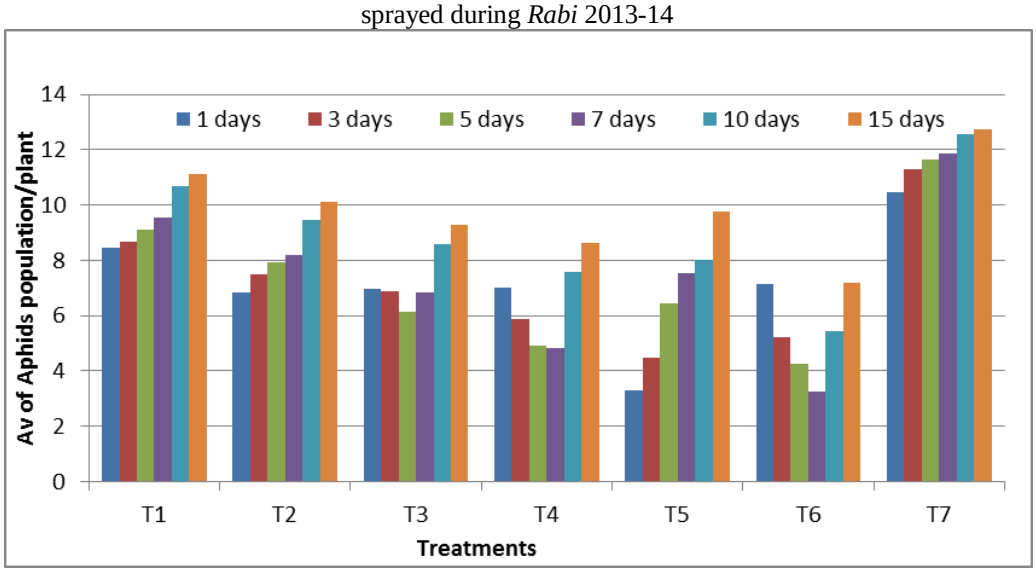

Fig.-2: Mean of aphid population / plant against after on okra crop first and second spraying of insecticidal treatments

Table 1. Bioefficacy of different insecticides against aphid population / plant on okra crop after first sprayduring *Rabi* 2013-14

Treatment No.	Treatment name	Dose (gm a.i.ha^{-1})	Pre-treatment population	Post –treatmentpopulation						Mean
				1 day	3 day	5 day	7 day	10 Day	15 day	
T_1	Emamectin benzoate 5 SG	8.0 0	10.40 (3.36)	8.65 (3.09)	8.78 (3.11)	9.01 (3.15)	9.77 (3.26)	10.01 (3.31)	10.33 (3.36)	**9.41**
T_2	Emamectin benzoate 5 SG	10.00	11.20 (3.49)	6.45 (2.72)	7.41 (2.89)	7.50 (2.91)	7.90 (2.98)	8.57 (3.08)	9.36 (3.21)	**7.87**
T_3	Emamectin benzoate 5 SG	11.00	9.55 (3.23)	5.55 (2.53)	5.89 (2.60)	6.13 (2.65)	8.12 (3.00)	8.45 (3.06)	8.56 (3.08)	**7.12**
T_4	Emamectin benzoate 5 SG	13.00	8.90 (3.14)	6.14 (2.65)	5.42 (2.52)	4.22 (2.63)	3.55 (2.12)	7.90 (2.98)	8.71 (3.11)	**5.99**
T_5	Cypermethrin 10EC	50.00	10.80 (3.43)	3.22 (2.01)	5.11 (2.47)	5.98 (2.29)	6.26 (2.67)	7.21 (2.92)	9.17 (3.18)	**6.16**
T_6	Spinosad 45 EC	75.00	9.22 (3.18)	6.05 (2.65)	4.42 (2.32)	4.32 (3.38)	4.19 (1.76)	5.45 (2.51)	7.05 (2.83)	**4.91**
T_7	Control	Untreated	9.36 (3.20)	9.39 (3.21)	10.11 (3.32)	10.56 (3.38)	10.57 (3.39)	11.55 (3.84)	11.89 (3.53)	**10.68**
SE(m)+-			**0.07**	**0.11**	**0.07**	**0.14**	**0.13**	**0.12**	**0.09**	
CD at 5%			**NS**	**0.34**	**0.23**	**0.45**	**0.40**	**0.36**	**0.30**	

* Three times replicated on each treatment, * Figure is parenthesis in square root transformed values

Table 2. Bioefficacy of different insecticides against aphid population / plantokra crop after second sprayduring *Rabi* 2013-14

Treatment No.	Treatment name	Dose (gm a.i.ha^{-1})	Pre-treatment population	Post –treatmentpopulation						Mean
				1 day	3 day	5 day	7 day	10 Day	15 day	
T_1	Emamectin benzoate 5 SG	8.0 0	12.11 (3.61)	8.25 (3.02)	8.56 (3.08)	9.25 (3.17)	9.36 (3.20)	11.32 (3.50)	11.87 (3.58)	**9.77**
T_2	Emamectin benzoate 5 SG	10.00	11.30 (3.50)	7.21 (2.98)	7.54 (2.90)	8.36 (3.05)	8.52 (3.07)	10.32 (3.35)	10.85 (3.44)	**8.80**
T_3	Emamectin benzoate 5 SG	11.00	10.60 (3.39)	8.36 (3.04)	7.85 (2.96)	6.12 (2.66)	5.56 (2.54)	8.74 (3.09)	10.05 (3.31)	**7.78**
T_4	Emamectin benzoate 5 SG	13.00	12.03 (3.60)	7.85 (2.96)	6.32 (2.68)	5.58 (2.56)	6.08 (2.61)	7.23 (2.86)	8.56 (3.08)	**6.94**
T_5	Cypermethrin 10EC	50.00	10.54 (3.39)	3.42 (2.09)	3.89 (2.17)	6.94 (2.81)	8.78 (3.11)	8.84 (3.12)	10.32 (3.36)	**7.03**
T_6	Spinosad 45 EC	75.00	12.36 (3.65)	8.25 (3.03)	6.01 (2.64)	4.22 (2.27)	4.34 (2.30)	5.41 (2.53)	7.31 (3.04)	**5.92**
T_7	Control	Untreated	11.51	11.56	12.45	12.74	13.12	13.54	13.62	**12.84**

			(3.52)	(3.49)	(3.66)	(3.70)	(3.74)	(3.81)	(3.02)	
SE(m)+-			**0.02**	**0.04**	**0.08**	**0.13**	**0.14**	**0.12**	**0.11**	
CD at 5%			**NS**	**0.13**	**0.26**	**0.43**	**0.44**	**0.39**	**0.36**	

* Three times replicated on each treatment, * Figure is parenthesis in square root transformed values

Table 3. Mean of aphid population / plant on okra crop against after first and second sprayed of insecticidal treatments

Treatment No.	**Treatment name**	**Aphid population / plant**						**Pooled Mean**
		1 day	**3 day**	**5 day**	**7 day**	**10 Day**	**15 day**	
T_1	Emamectin benzoate 5 SG	8.45	8.67	9.13	9.57	10.67	11.10	**9.60**
T_2	Emamectin benzoate 5 SG	6.83	7.48	7.93	8.21	9.45	10.11	**8.33**
T_3	Emamectin benzoate 5 SG	6.96	6.87	6.13	6.84	8.60	9.31	**7.45**
T_4	Emamectin benzoate 5 SG	7.00	5.87	4.90	4.82	7.57	8.64	**6.46**
T_5	Cypermethrin 10EC	3.32	4.50	6.46	7.52	8.03	9.75	**6.60**
T_6	Spinosad 45 EC	7.15	5.22	4.27	3.27	5.43	7.18	**5.42**
T_7	Control	10.48	11.28	11.65	11.85	12.55	12.76	**11.76**

CONCLUSION

The minimum aphid population(5.42 aphid/ plant) was observed in foliar application of treatment (T_6) spinosad 45EC @75g a.i./ ha followed by treatment (T_4) Emamectin benzoate 5 SG@13 g a.i./ha(6.46aphid/ plant).The maximum 9.60 aphid/ plant was recorded in treatment (T_1) Emamectin benzoate 5 SG@8 g a.i./ha.Thus, treatmentspinosad 45EC was found to be the best effective treatment and minimized the aphid population

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EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON PRODUCTIVITY OF MAIZE

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Abstract: The field experimentwas conducted during *kharif*, 2014 at the Instructional Farm of the Rajasthan College of Agriculture, Udaipur. The soil of the experimental site was sandy clay loam in texture slightly alkaline in reaction, medium in available nitrogen and phosphorus and high in potassium, sulphur and zinc. The experiment consisted of 12 treatments comprising chemical fertilizers, organic manure, and their combinations, *viz*., , 100 % RDF + FYM at 10t ha^{-1}, 75 % RDF + FYM at 10t ha^{-1}, 50 % RDF + FYM at 10t ha^{-1}, 100 % RDF + vermicompost at 4t ha^{-1},75 % RDF + vermicompost at 4t ha^{-1}, 50 % RDF + vermicompost at 4t ha^{-1} , FYM at 20t ha^{-1}, vermicompost at 8t ha^{-1}, 100 % RDF, 75 % RDF, 50 % RDF, and control These treatments were evaluated under randomized block design (RBD) with three replications. Maize cultivar (pratapmakka- 5) was taken as test crop. The results revealed that the yield of maize crop in terms of grain, stover and biological yield (2766, 7796, 10562 kg ha^{-1}) were maximum by applying 100% RDF + Vermicompost 4 t ha^{-1} though the results were at par with those obtained by applying 100% RDF + FYM 10 t ha^{-1}.

Keywords: Vermicompost, FYM, Maize, RDF, biological yield

INTRODUCTION

In India, effective nutrient management has played a major role in accomplishing the enormous increase in food grain production from 52 million tonnes in 1951-52 to 264.38 million tonnes during 2014. However, application of imbalanced and excessive nutrients lead to declining nutrient-use efficiency making fertilizer consumption uneconomical and producing adverse effects on atmosphere (Aulakh and Adhya, 2005) and ground water quality (Aulakh*et al.*, 2009) causing health hazards and climate change. Integrated nutrient management(INM), which entails the maintenance/adjustment of soil fertility to an optimum level for crop productivity to obtain the maximum benefit from all possible sources of plant nutrients organics as well as inorganics in an integrated manner (Aulakh and Grant, 2008), is an essential step to address the twin concerns of nutrient excess and nutrient depletion. Integrated nutrient management is also important for marginal farmers who cannot afford to supply crop nutrients through costly chemical fertilizers. FYM is one of the components of INM as it a cheap and easily available source of organic nutrients. Integrating FYM with inorganic fertilizer, scientists are getting very good response of the crop. Application of this source of organic improves physical, chemical and biological condition of the soils. FYM can supply all the nutrients required by the plant, however with low quantity.Vermicompost is a nutrient rich compost which helps better plant growth and crop yield, improves physical structure of soil, enriches soil with micro-organisms, attracts deep-burrowing earthworms already present in the soil which indirectly improves fertility of soil, increase water holding capacity of soil, enhances germination, plant growth, and crop yield, improves root growth of plants, enriches soil with plant hormones such as auxins and gibberellic acid. It is helpful in elimination of biowastes.

MATERIAL AND METHOD

The experiment consisted of 12 treatments comprising chemical fertilizers, organic manure, and their combinations, *viz*., , 100 % RDF + FYM at 10t ha^{-1}, 75 % RDF + FYM at 10t ha^{-1}, 50 % RDF + FYM at 10t ha^{-1}, 100 % RDF + vermicompost at 4t ha^{-1},75 % RDF + vermicompost at 4t ha^{-1}, 50 % RDF + vermicompost at 4t ha^{-1} , FYM at 20t ha^{-1}, vermicompost at 8t ha^{-1}, 100 % RDF, 75 % RDF, 50 % RDF, and control.The dose of the NPK for maize was worked out from IPNS equations developed for maize crop for 2.5 t/ha yield target. The NPK dose in kg ha^{-1} worked out was 90: 40: 40 for maize crop. The doses for farm yard manure and vermicompost is 10 t ha^{-1}and 8 t ha^{-1}, respectively. The FYM and Vermicompost were applied before sowing of the maize crop (content of FYM and Vermicompost given below Table 1).

Table 1. Composition of FYM and Vermicompost

Nutrient	FYM (%)	Vermicompost (%)
N	0.48	2.94
P_2O_5	0.18	0.96
K_2O	0.45	1.42

*Corresponding Author

Treatment application

FYM and vermicompost incorporated in soil before month of sowing while,Fertilizer application was made as per the treatment. Full dose of phosphorus and potash and half dose of nitrogen were applied at sowing by drilling in crop rows. The remaining dose of nitrogen was top dressed in two split doses at 30 DAS and 50 DA

Yield parameters viz., grain yield and stover yield observed in following manner

a) **Grain yield:** Cobs of harvested plants of net plot area after proper sun drying were separated from plants, dehusked and shelled with the help of cob sheller. The produce was cleaned, weighed and expressed in terms of grains kg ha^{-1}.

b) **Stover yield:** Stover yield was obtained by subtracting the grain yield per plot from the respectively biological yield per plot and finally expressed in terms of stover yield kg ha^{-1}.

RESULT AND DISCUSSION

Grain yield

An examination of data (Table 2. and Fig.1) revealed that the variation in grain yield of maize varied from 1475.56 to 2766.13 kg ha^{-1}. Significant enhancement in grain yield of maize was recorded by applying various treatments to supply nutrients. The highest grain yield (2766.13 kg ha^{-1}) was recorded by application of 100 % RDF + Vermicompost 4 t ha^{-1} and which was followed by 100% RDF + FYM 10 t ha^{-1} which represents 88 and 79 per cent increase yield over control.

Stover yield

Based on measured data (Table 2 and Fig.1) it can be inferred that stover yield was significantly increased by enriching the soil with various treatments over no fertilization. The increase in yield varied from 4127.81 to 7796.69 kg ha^{-1}. The application of 100% RDF + Vermicompost 4 t ha^{-1} produced highest stover yield (7796.69 kg ha^{-1}) and which was followed by 100% RDF + FYM 10 t ha^{-1} which represents 89 and 82 per cent increase yield over control.

Biological yield

A perusal of data presented in Table 2and Fig 1. show that biological yield varied from 5603.37 to 10562.82 kg ha^{-1} during study by applying various treatments to supply nutrients. An application of 100% RDF + Vermicompost 4 t ha^{-1} recorded significantly highest yield (10562.82 kg ha^{-1}) and which was followed by 100% RDF + FYM 10 t ha^{-1} which represents 89 and 81 per cent increase yield over control.

Table 2. Effect of treatments on yield and harvest index in maize

Treatment	Yield (kg ha^{-1})			Harvest Index (%)
	Grain	Stover	Biological	
T_1 - Control	1475	4127	5603	26.34
T_2 - 50% RDF	1676	4705	6381	26.38
T_3 - 75% RDF	1840	5131	6971	26.58
T_4 - 100% RDF	1918	5202	7120	30.79
T_5 - Vermicompost at 8 tha^{-1}	1845	5140	6985	26.42
T_6 - FYM at 20 tha^{-1}	1795	5062	6857	26.18
T_7 - 50% RDF + vermicompost at 4t ha^{-1}	1801	4980	6781	26.67
T_8 - 75% RDF+ vermicompost at 4t ha^{-1}	1964	5406	7370	26.77
T_9 - 100% RDF+ vermicompost at 4t ha^{-1}	2766	7796	10562	26.21
T_{10} - 50% RDF + FYM at 10 t ha^{-1}	1750	4830	6580	26.59
T_{11} - 75% RDF+ FYM at 10 t ha^{-1}	1920	5294	7214	26.62
T_{12} -100% RDF+ FYM at 10 t ha^{-1}	2643	7510	10153	26.02
SEm±	67.031	233.196	253.904	1.022
CD (p=0.05)	194.181	675.542	735.531	2.961
C.V.%	5.81	7.38	5.88	6.61

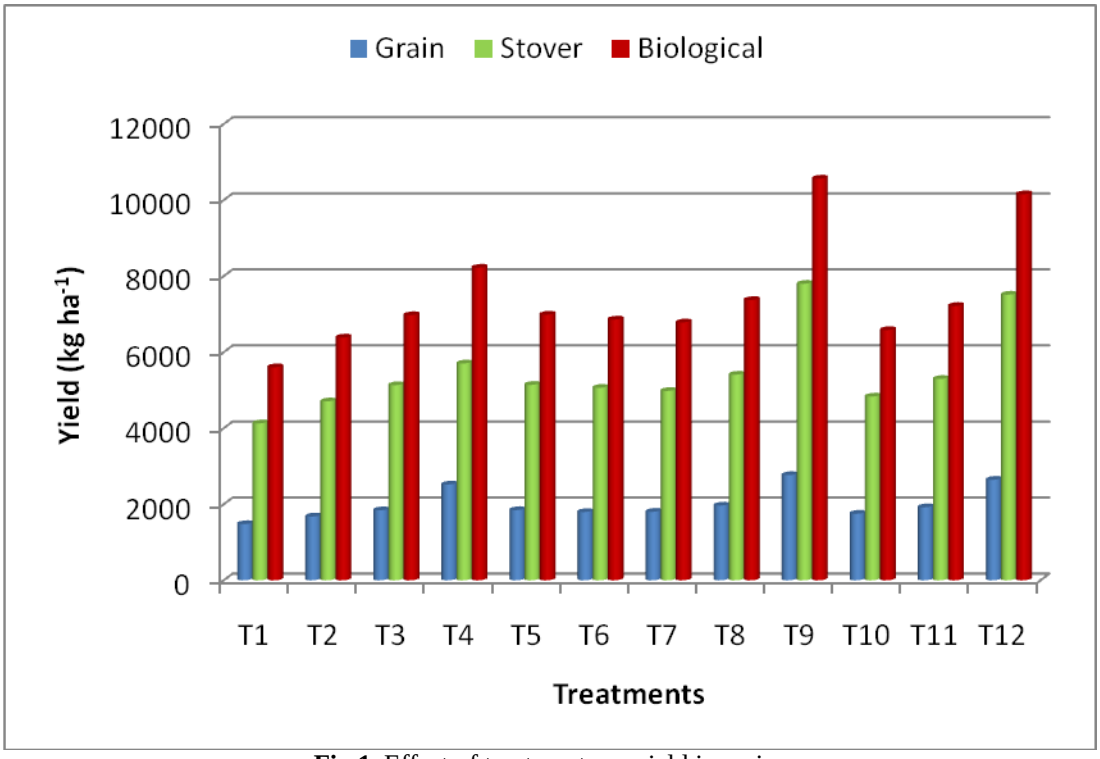

Fig 1. Effect of treatments on yield in maize

The results showed that balanced fertilization of maize crop involving nutrient combinations of N, P and K, with vermicompost and FYM most effectively enhanced various yield components in maize *viz.* grain, stover, biological yield were maximized when crop was fertilized with balanced and increased levels of nutrient combinations.The highest grain yield realized with application of balanced and higher level of plant nutrition could be ascribed due to its profound influence on vegetative and reproductive growth of the crop. Hence, marked increase in grain yield with balanced and higher level of fertilization seems to be due to exploitation of crop genetic potential for vegetative and reproductive growth. The best result on grain yield was obtained with application of 100 % NPK + vermicompost 4 t ha^{-1} which was 88 per cent higher over control. This indicates that maize responds well to integrated nutrient management. The results of the present investigation indicating positive response of maize crop to balanced fertilization are alike to findings of several researchers (Kumpawat, 2004; Kumar, 2008 and Mehta *et al*., 2011).

Application of integrated nutrient as 100 % NPK + vermicompost 4 t ha^{-1} increased yield components of maize crop significantly over control and at par with 100 % NPK + FYM 10 t ha^{-1}(Table 4.1). The significant interactive effect as a consequence of Vermicompost and fertilizer application is attributed to the favorable nutritional status of the soil resulting into increased biomass production of the crop. This may also be attributed to favorable effect of Vermicompost on microbial and root proliferation on soil which caused solubilizing effect on native phosphorus and other nutrients. Integrative chemical fertilizers and organic manures was, however, found to be quite promising not only in maintaining higher productivity but also in providing greater stability in crop production by synergistic effect of Vermicompost on improving efficiency of optimum dose of NPK. The results of the present study that Combined use of organic manure and chemical fertilizer has been found to be providing higher productivity with those reported by Ramesh *et al.* (2008), Dadarwal*et al*. (2009), Kannan*et al*. (2013) Singh *et al.* (2010), Behera and Singh, (2009), Paradkar*et al.* (2010), Sharma and Banik (2011). Data presented in Table 2. show that significant increase in stover yield due to higher fertility levels and balanced fertilization (100 % NPK + vermicompost 4 t ha^{-1}) could be ascribed to their direct influence on dry matter production in leaf and stem at successive stages by virtue of increased photosynthetic efficiency. The profound influence of nutrient application on biological yield seems to be on account of its influence on vegetative (stover) and reproductive growth (grain) with those reported by Singh *et al*., 2006; Kar*et al*., 2006; Choudhary*et al*., 2007; Singh *et al.*, 2012.

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EFFECT OF DISTILLERY SPENT WASH ON SUGAR CONTENT OF *STEVIA REBAUDIANA* BERTONI

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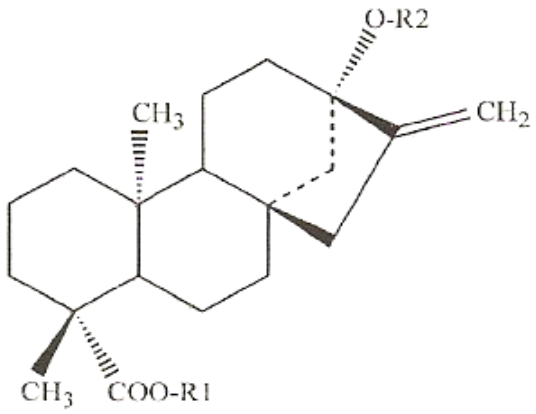
Abstract: *Stevia*, a plant of Paraguay, belongs to family Asteraceae. *Stevia rebaudiana* is a non- caloric, sweetener economically important medicinal plant used for a number of medical treatments. The plant consists of steviosides which are 250-300 times sweeter than ordinary table sugar. The steviosides are non-caloric and hypoglycemic. In India, distilleries are important part of industry, produce wastewater called spent wash. The distillery spent wash is rich in organic and inorganic salts that could be used as irrigation water. The present investigation has been conducted to demonstrate effect of distillery spent wash on sugar content of plant.

Keywords: *Stevia*, Sugar content, Distillery spent wash, Steviosides

INTRODUCTION

Stevia rebaudiana Bertoni, a native plant of Paraguay, is a member of family Asteraceae. It is a herbaceous, perennial herb growing in semi humid and sub tropical (Brandle and Starratt, 1998). *Stevia* is used for a number of medical treatments such as hypoglycemic, hypotensive, antiviral, antifungal, antibacterial, digestive tonic, weight loss programs, fatigue, depression, wound healer, tooth decay etc. (Sarika and Arora, 2009).
(steviosides and rebaudiosides) which are 250-300 times more sweet than ordinary table sugar (Lester, 1999).A number of plant chemicals have been investigated from *Stevia. Stevia* come in attention due to its natural, non-caloric sweetener commonly called as glycosides (steviosides and rebaudiosides) which are 250-300 times more sweet than ordinary table sugar (Lester, 1999).. The two main glycosides are stevioside, 5-10% of the dry weight of the leaves and rebaudioside A (R-A), 2-4 % of the dry weight of the leaves. Yield of sweetening compound in leaf tissue can vary according to method of propagation, day length (Metivier and Viana, 1979) and agronomic practice (Shock, 1982).



Central structure of steviosides and related compounds

There are about 579 sugar mills and 285 distilleries in India. Apart from sugar and alcohol, these factories generate many by-product and waste material (Sindhu *et al.*, 2007). Molasses a by-product of sugar industry is being used as a raw material in distilleries for the production of alcohol, which gives considerable income to these industries. However, for every liter of alcohol production about 10-15 liters of wastewater known as spent wash is produced. About 40 billion liters of spent wash is generated from distilleries in India (Chidankumar *et al*., 2009). Spent wash is acidic and loaded with organic and inorganic salts. Being plant origin, the spent wash contains considerable amounts of plant nutrient and organic matter (Sindhu *et al.*, 2007). Spent wash in acidic effluent rich in organic carbon , K , Ca, Mg and S, considerable amount of N, P, traces of micronutrient *viz* Fe, Mn, Zn and Cu and traces of sugar are also observed (Saliha *et al.*,). The distillery industrial spent wash is non-toxic, biodegradable, purely of plant origin and nutrients (Alam *et al.*, 2008).

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Distillery spent wash is used for irrigation purpose in many countries including India. Irrigation with distillery wastewater seems to be an attractive agricultural practice, which not only augment crop yield but also provides a plausible solution for the land disposable of the effluent (Samuel, 1986). The present investigation had been done to analyzed effect of distillery spent wash on sugar content of *Stevia rebaudiana.*

MATERIAL AND METHOD

For raising the crop, vegetative method was used. Propagules that are stem cuttings were propagated and sampling was done fortnightly from 60 to 135 days of growth. Plants were treated with different concentration of spent wash collected from M/S Sir Shadilal Distillery and Chemical Works, Mansoorpur, Muzaffarnagar (5.0, 10.0, 15.8, 25.1, 36.6 and 39.8%). Plants treated with ordinary water treated as control.

Dried leaves were extracted with 100 ml of hot water for 2 hours at 70^0C. The extract was filtered with Whatman No. # 1 filter paper and the clear solution were concentrated to 40 ml on a rotatory evaporator at 60^0C and 20 mm pressure. The pH of this concentrate was brought down to pH 3.5 with fumaric acid. It was filtered and pH is readjusted to 10 with dilute sodium hydroxide. A pasty mass was separated out. It was filtered and pH is readjusted to 8.5 with the addition of potassium aluminum sulpahte (alum). The solution was clear and completely clarified. It was let stand for servel hours and distilled with n-butanol (Pasquel *et al.,* 2000).

RESULT AND DISCUSSION

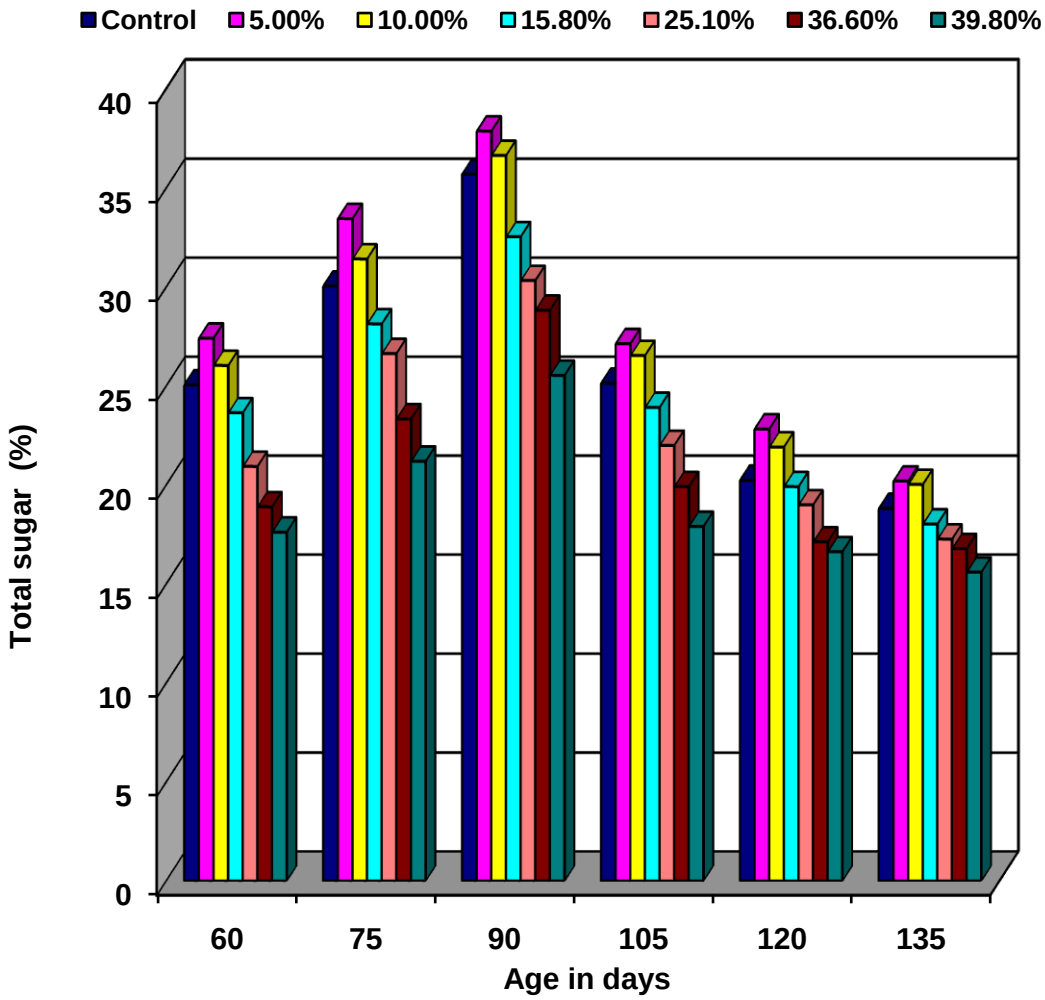
Total sugars of leaf of *Stevia rebaudiana* increase from 60 to 90 days of growth and thereafter decreases form 105 to 135 days of growth. Total sugars was found to be slightly more in the presence of 5.0% and 10.0% spent wash in comparison to the control whereas in the presence of 15.8% spent wash, the same was slightly lower thanthat of control. Decrease in sugar content after 90 days of growth may be due to initiation of flowering in the plant.

TOTAL SUGARS (%) OF LEAF

Concentration of spent wash	Age in days					
	60	75	90	105	120	135
Control	25.04±0.02	30.03±0.02	35.68±0.09	25.12±0.03	20.22±0.02	18.80±0.80
5.0%	27.40±0.03	33.44±0.06	37.86±0.10	27.12±0.08	22.81±0.01	20.18±0.25
10.0%	26.02±0.04	31.40±0.05	36.63±0.12	26.52±0.04	21.90±0.30	20.01±0.41
15.8%	23.63±0.21	28.12±0.20	32.52±0.01	23.90±0.01	19.90±0.32	18.01±0.50
25.1%	20.92±0.03	26.62±0.02	30.31±0.31	21.98±0.02	18.98±0.03	17.25±0.54
36.6%	18.88±0.03	23.32±0.09	28.81±0.08	19.90±0.08	17.11±0.06	16.77±0.05
39.8%	17.60±0.08	21.18±0.08	25.52±0.07	17.89±0.09	16.61±0.08	15.58±0.06

Values are mean ± S.E

Decrease in the total sugars of leaf as flowering commences has been reported by many workers (Shock, 1982; Lester, 1999). Harvesting is suggested to be done before flowering as, sugar content was higher just before flowering (Bian, 1981). Increase in the biomass of inflorescence form 105 to 135 days of growth in higher concentrations of spent wash with simultaneous decrease in the sugar content supports this view. Total sugars decrease in rest of the spent wash concentrations used (15.8% to 39.8%). The extent of decrease in total sugars of leaf increases with the increase in the concentration of spent wash.



Total sugars (%) of *Stevia rebaudiana* Bertoni at different days interval treated with different concentrations of spent wash.

Decrease in total sugars under the treatment of these concentrations was probably due to deficiency of potassium and phosphorus in this concentration. Utumi *et al.*, 1999 reported that deficiency of K and P decrease the sugar content of leaf of *Stevia rebaudiana*. Das *et al.*, 2006 studied effect of N, P and K on sugar content in *Stevia*. They observed that application of NPK fertilizers enhances total biomass as well as sugar content in *Stevia* plants. The sweetening effect of these compounds is purely by taste; they are undigested and the body absorbed no part of the chemical. They are therefore of no nutritional value (Hutapea *et al*., 1997).

The present investigation has been carried out to observe effect of spent wash on sugar content of *Stevia.* It may be concluded that low concentration of spent wash increase the sugar content of plant and hence recommended.

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SYNOPTIC ANALYSIS OF FABACEAE *S.L.* (LEGUMINOSAE) OF SOME AREAS OF DISTRICT RAJOURI (J&K), INDIA

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Abstract: The present communication deals with the documentation of members of family fabaceae from three tehsils of district Rajouri (J&K), India. A total of 51 species have been collected from the study area.

Keywords: Blotters, Fabaceae, Legume, Mimosoideae, Voucher number

INTRODUCTION

The state of Jammu and Kashmir lies between the coordinates 32º17' and 36º58' North Latitudes and 73º26' and 80º30' East Longitudes. It covers an area of 2,22,236 Km^2 and $_{an}$ altitudinal variation of 300-6500m above mean sea level.

The variations in the climate are from tropical, subtropical to alpine, the annual precipitation ranges between 107-650 mm, with an average of 600 mm of snow during winter. The temperature fluctuates between 15ºC to 43ºC during summer and between -3ºC to 26ºC in winter. Compilation by various authors has shown several legume species growing wild here. Last compilation on Indian legumes by Sanjappa (2010) puts on record 179 genera and 1152 species. Out of these, 36 genera and 80 species of leguminosae are listed in the "Flora of Jammu" by Sharma and Kachroo (1981). 28 legume species find place in "Weed Flora of Kashmir valley" by Kaul (1986). Bhellum and Magotra (2012) in "A catalogue of Flowering plants of Doda, Kishtwar and Ramban districts" mention 70 genera of Papilionoideae, 4 genera of Caesalpinoideae and 4 genera of Mimosoideae. Legume flora of several areas remains unexplored. Rajouri district of the state covering an area of 2630 km^2 , lying between $30^0 50^{'}$ N to $33^0 30^{'}$ N longitude and 74^0E to $74^0 10^{'}$ E latitude is one such region. This area has a wide altitudinal range of 490-4700m and harbours great floral diversity. No comprehensive work is however available on the legumes of this area except for "Climbing weeds of Agricultural crops of District Rajouri, J&K, India" (2012), by Dangwal and Singh mentions 4 legume species and "Dye yielding Plant Diversity of district Rajouri, J&K, India" by Rashid (2013) also mentions 9 legume species. Present work was designed to explore the legume diversity of the region.

MATERIAL AND METHOD

Periodic field trips were undertaken in rural and mountainous areas of the study area (all the three tehsils, namely Sunderbani, Nowshera and Rajouri).Trips to distant parts were of the duration of 3 to 7 days each. Same site was visited in different seasons of the year so as to raise collections in all seasons of the year. While collecting specimens, voucher numbers were allotted to each specimen and details were entered in the field notebook. Field data collected for every specimen included local name, date of collection, place of collection, altitude, voucher number, flower colour, fragrance, soil characters and other such characters which are not retained on pressing. Herbaceous plants were collected as whole, for others, tender flower and fruit bearing twigs were selected and cut with the help of pruning knife or secateurs. The plants collected were pressed in old newspapers and blotters. The press was locked up for about 24 hours. Thereafter it was opened and blotters changed. Wherever necessary, plant press were rearranged to bring them to desired position. The process of changing blotters was done after every 24-36 hours for 3-4 days to reduce discolouration of foliage and flowers and to avoid rotting. In summer months, the process of drying took 4-6 days while during winters, it extended to 6-11 days.

RESULT AND DISCUSSION

51 species of family Fabaceae abounding three tehsils of district Rajouri of J&K state, India were enumerated from the area (Table 1) and form the collection of the present survey. Covering an altitudinal gradient of 426-1015 msl and known by different local names, these taxa were found to reproduce sexually. These bear different coloured flowers. Some important aspects like distribution, habit, flower colour, flowering and fruiting period and place of collection (along with altitude) of these species are summarised in the table 1. Subfamily papilionoideae is most dominant one in the collection being represented by 23 genera and 36 species constituting 70.58 % of the total sample. Members of the subfamilies Caesalpinioideae and Mimosoideae occur almost in equal distribution. Caesalpinioideae is represented by 3 genera and 8 species representing

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15.68 % of total species count while Mimosoideae is represented by 4 genera and 7 species constituting 13.73% of the total species count. Most of the legumes encountered during present survey are herbs. These constitute 55% (28 species) of the total collection. Trees and shrubs are less represented and form 23.53 (12 species) and 21.57 % (11 species) of the total samples size.

Table 1. List of species collected from the study area

S.N.	Name of species	Common name	Local name	Flower colour	Flowering and fruiting period	Specimen collected from	Altitude (msl)
01	*Abrus precatorius* L.	Indian liquorice	Ratti	Pink	August-October	Khori (Rajouri)	863
02	*Argyrolobium roseum* (Cambess.) Jaub& Spach	Makhan Booti	Hazardani, Bahu Phalli\	White	March-September	Chanmari (Rajouri)	924
03	*Astragalus leucocephalus* Bunge	-	Pattri	White with a little yellow tinge	March-May	Palulian (Rajouri)	1015
04	*Atylosia scarabaeoides* (L.) Benth.	Wild Kulthi	Sayali	Yellow	May-October	Agrati (Rajouri)	796
05	*Butea monosperma* (Lam.) Taub	Flame of the Forest	Kaag-ka-boota, Kinji	Orange Red	March-May	Kallar (Rajouri)	825
06	*Caraqana gerardiana* Royle ex Benth.	-	Pattaki	Yellow	April-June	Dassal (Rajouri)	946
07	*Crotalaria medicaginea* Lam.	Trefoil Rattlepod	Kuuchni	Yellow with a reddish tinge	April-September	Dassal (Rajouri)	985
08	*Crotalaria mysorensis* Roth.	Siberian Pea shrub	Chitryavalli	Yellow	August-September	Peelo Galla (Rajouri)	912
09	*Crotalaria prostrata* Willd.	Prostrate Rattlepod	-	Yellow	March-May	Kopra (Rajouri)	990
10	*Dalbergia sissoo* (Roxb.)	Mysore Rattlepod	Shisham, Talli	Creamyh white	March-May	Kangri (Nowshera)	503
11	*Desmodium gangeticum* (L.) DC.	Sal-leaved Desmodium	-	Pink	April-October	Dharwali Bawli (Rajouri)	935
12	*Desmodium laxiflorum* DC.	Linear-leaved tick-trefoil	Baboori kuuchni	Blue and white	July-September	Sema Chawa (Rajouri)	945
13	*Desmodium triflorum* (L.) DC.	3-flowered Beggar Weed	Jangli methi	Blue	May-July	Gaian (Rajouri)	922
14	*Eriosema himalaicum* H. Ohashi	Chinese bush Carrot	-	Yellow	July-September	Muradpur (Rajouri)	986
15	*Gueldenstaedtia verna* (Georgi) Boriss	Asian tiger mosquito	-	Whitish blue	April-July	Dharwali Bawli (Rajouri)	985
16	*Indigofera hebepetala* Ali	Fuzzy petal Indigo	-	Pink	May-September	Fatehpur (Rajouri)	969
17	*Indigofera heterantha* Wall.	Cool Indigo	Kathi	Pink	May-August	Muradpur (Rajouri)	936
18	*Indigofera linifolia* (L.f.) Retz.	Pandharphali	-	Pink	May-October	Kangala (Rajouri)	994
19	*Indigofera tinctoria* L.	Nili	Kathi	Pink	March-May	Saranoo (Rajouri)	885

20	*Lathyrus aphaca* L.	Yellow vetchling	Bandkla, Janglimattar	Creamy white	March-April	Kallar (Rajouri)	847
21	*Lespedeza juncea* (L.f.) Persoon	Bush clover	-	White with purple tinge	April-September	Chingus (Rajouri)	796
22	*Lotus corniculatus* L.	Bird's foot trefoil	-	Yellow	April-July	Palam (Rajouri)	879
23	*Medicago lupulina* L.	Black Hay	Sariri	Yellow	March-May	Siot (Sunderbani)	426
24	*Medicago polymorpha* L.	California burclover	Sariri, Khitmi	Yellow	March-May	Sunderbani	449
25	*Melilotus indica* (L.) All.	Indian Sweet clover	Barseem	Yellow	March-May	Dhanidhar (Rajouri)	918
26	*Rhynchosia minima* (L.) DC.	Burn-mouth-vine	Jangli Moath	Yellow	June-August	Dharwali Bawli (Rajouri)	963
27	*Robinia pseudoacacia* L.	Black Locust	Kikar	CreamyWhite	March-May	Khandali (Rajouri)	911
28	*Tephrosia purpurea* (L.) Pers.	Wild Indigo	Sirphonka	Pink	March-May	Dabura (Nowshera)	499
29	*Trifolium alexandrinum* L.	Barseem clover	Barseem	Creamy white	March-April	Banja Bain (Sunderbani)	549
30	*Trifolium campestre* Schreb.	Low Hop Clover		Yellow	February-April	Dassal (Rajouri)	946
31	*Trifolium pratense* L.	Red clover	Shattal	Pink	April-June	Agrati (Rajouri)	785
32	*Trifolium repens* L.	White clover	Jangli Shattal	Creamywhite with a brownish tinge	March-April	Baja bain (Sunderbani)	537
33	*Trifolium resupinatum* L.	Persian clover	Shatala	Pink	April-June	Agrati (Rajouri)	801
34	*Uraria picta* (Jacq.) DC.	Shankaraja	-	White and pink	August-September	Muradpur (Rajouri)	905
35	*Vicia hirsuta* (L.) Gray	Tiny vetch	Papda	White	March-April	Jaba (Nowshera)	503
36	*Vicia sativa* L.	Common vetch	Jowal, Phalli	Pink	March-April	Siot (Sunderbani)	454
37	*Bauhinia purpurea* L.	Butterfly tree	Kachnar	Pink	March-April	Narian (Nowshera)	734
38	*Bauhinia variegate* L.	Mountain ebony	Kaliari	White with a pink tinge	March-May	Chachera (Rajouri)	995
39	*Caesalpinia Decapetala* (Roth) Alston	Cat's claw	-	Yellow streaked with red	April-June	Saranoo (Rajouri)	851
40	*Cassia absus* L.	Tropical Sensitive Pea	-	Yellow with a reddish tinge	August-October	Dalogra (Rajouri)	875
41	*Cassia fistula* L.	Golden Shower tree	Karangal, Amaltas	Yellow	June-September	Sial (Nowshera)	512
42	*Cassia mimosoides* L.	Feather-leave Cassia	-	Yellow	August-October	Simbal Gahi (Rajouri)	996
43	*Cassia occidentalis* L.	Foetid Cassia	-	Yellow	August-October	Banja bain (Sunderbani)	537
44	*Cassia tora* L.	Sickle Senna	Panwar, Ehrma	Yellow	June-August	Seri (Nowshera)	548
45	*Acacia catechu* (L.f.) Willd.	Cutch tree	Khair, Khadar	Creamy white	June-September	Muradpur	895
46	*Acacia nilotica*	Gum	Kikar,	Yellow	March-May	Charyal	605

	(L.) Willd. ex Delile	Arabic tree	Babul			(Nowshera)	
47	*Acacia modesta* Wall.	Blacksally	Phalai, Kallmai	Creamy white	March-july	Qila Nowshera	822
48	*Albizzia lebbeck* (L.)	Lebbeck tree	Sariin	Creamy white	April-August	Qila Nowshera	822
49	*Leucaena leucocephala* (Lam.) de Wit.	Horse tamarind	Pallai	Creamy white	April-August	Kalal (Nowshera)	770
50	*Mimosa pudica* L.	Sensitive Plant	Chui-mui	Pink	June-August	Peelo Galla (Rajouri)	879
51	*Mimosa rubicaulis* Lam.	Himalayan Mimosa	Raal (Raali)	White and Pink	July-September	Lamberi (Nowshera)	652

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CONSTRAINTS FACED BY FISHERY COOPERATIVE SOCIETIES, SELF HELP GROUPS AND FISHERMEN GROUPS REGARDING FISH PRODUCTION IN BASTAR DISTRICT OF CHHATTISGARH

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Abstract: The study was undertaken in Bastar district of Chhattisgarh state to know the constraints perceived by the respondents of fishery cooperatives societies, SHGs and fishermen groups in various aspects of fish production. Six purposively selected blocks namely Jagdalpur, Bastar, Lohandiguda, Tokapal, Bakawand and Darbha located in Bastar district were selected and interviewed personally. The important constraints perceived by the respondents were heavy weed infestation, conflicts due to multipurpose use of ponds, involvement of middlemen, high netting charges as well as unavailability of transport facility.

Keywords: Fishery cooperatives societies, SHGs, Fishermen groups, Constraints, Fish production

INTRODUCTION

Fisheries sector occupies a very important place in the socio-economic development of the country, as it contribute to economic growth and human welfare. Fisheries sector has been recognized as the powerful income and employment generator for the poor people of rural area.

Despite the technological breakthrough in fisheries sector and strengthening of extension programmes the yield of fish production in Chhattisgarh as well as in Bastar district are far below the yield potential and the target level of production and marketing. The problem is to increase the production of fish culture and how to break the constant trend of lower yield per unit of water area in Bastar district of Chhattisgarh. One of the greatest problems is the production gap between the existing production and the production based on scientific technology. With the prevailing production gap, the fish producers of Bastar district are not only losing every year their earning capacity but their standard of living is also going down. Looking towards increase in area under fish production in Bastar District, present study was carried out to know the constraints faced by the respondents in fish production.

MATERIAL AND METHOD

Interview schedule was developed according to the objectives of research study. The data were collected through the personal interview schedule from six purposively selected blocks namely Jagdalpur, Bastar, Lohandiguda, Tokapal, Bakawand and Darbha located in Bastar district of Chhattisgarh. The sample size was comprised of numbers 10, 21 and 43 members from the fishery cooperative societies, SHGs and fishermen groups respectively, with overall respondents being 74.The data were tabulated and analysis on the basis of frequency and percentage.

RESULT AND DISCUSSION

(a) Constraints faced by Fishery co-operative Societies, SHGs and Fishermen Groups related to production and marketing of fish

It is observed from (Table 1) in case of fishery co-operative societies, natural calamities like viral diseases swim bladder infection and flood had been faced by 10.00 % while 90.00 % did not face any of the natural calamity like disease, flood etc. 100.00 % respondents of fishery co-operative societies did not face the problem of heavy weeds in the ponds. Ponds under fishery co-operative societies reported 100.00 % of multipurpose use of ponds like, human bathing, cattle bathing, washing clothes, utensils etc. Due to multipurpose use of ponds productivity was greatly affected and conflicts were also raised between the owners and non-owners, these non-owners due to multipurpose use restricted the medicine and disinfectants application in the ponds. Usufruct rights of non-owners for multipurpose use hampered the management of pond which leads to reduction in production levels. Conflicts intense during dry or summer season due to reduction in water level of pond, villagers resort to unfair means *i.e.* poaching due to which fish farmers are forced for netting while fish growth is greatly affected by the same. This was the main conflict reported by 100.00 % of fishery co-

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operative societies. 100.00 % of fishery co-operative societies reported to receive regular information of market prices, as well as reported that a small proportion of fish production is mandatory to sell in village market at a predetermined price mostly by each fishery co-operative society. 100.00 % of respondents disagree regarding the heavy price paid for acquisition of net. 100.00 % of respondents agree regarding receiving uniform price irrespective of species and size. Only 10.00 % have unavailability of transport facilities while 90.00 % of respondents have good transportation facilities. 100.00 % respondents had no issues of middlemen.

In case of SHGs, (Table 1) it was observed that natural calamities like viral diseases swim bladder infection and flood had been faced by 4.76 % while 95.23 % did not face any of the natural calamities like disease, flood etc. 100.00 % respondents of SHGs did not face problem of heavy weeds in the ponds. Ponds under SHGs reported of 100.00 % multipurpose use of ponds like, human bathing, cattle bathing, washing of clothes, utensils etc. Due to multipurpose use of ponds, productivity was greatly affected and conflicts were also raised between the owners and non-owners, these non-owners due to multipurpose use restricted the medicine and disinfectants application in the ponds. Usufruct rights of non-owners for multipurpose use hampered the management of pond which leads to reduction in production levels. Conflicts intense during dry or summer season due to reduction in water level of pond, villagers resort to unfair means *i.e.* poaching due to which fish farmers are forced for netting while fish growth is greatly affected by the same. This was the main conflict reported by 100.00 % of SHGs. 100.00 % of SHGs reported to receive regular information of market prices as well as reported that a small proportion of fish production is mandatory to sell in village market at a predetermined price mostly by each SHGs. 100.00 % of respondents disagree regarding the heavy price paid for acquisition of net. 100.00% of respondents agree regarding receiving uniform price irrespective of species and size. Only 4.76 % have unavailability of transport facilities while 95.23 % of respondents have good transportation facilities.100 % respondents had no issues of middlemen.

In case of fishermen groups (Table 1) it was observed that natural calamity like viral diseases, swim bladder infection and flood had been face by 11.62 % while 88.37 % did not face any natural calamity like disease, flood etc. 88.37 % respondents of fishermen groups did not faced the problem of heavy weeds in the ponds while 11.62 % faced in the heavy weeds in the ponds. Ponds under fishermen groups reported of 69.76 % multipurpose use of ponds like, human bathing, cattle bathing, washing of clothes, utensils etc while 30.23 % reported on such activities. Due to multipurpose use of ponds, productivity was greatly affected and conflicts were also raised between the owners and non-owners, these non-owners due to multipurpose use restricted the medicine and disinfectants application in the ponds. Usufruct rights of non-owners for multipurpose use hampered the management of pond which leads to reduction in production levels. Conflicts intensed during dry or summer season due to reduction in water level of pond, villagers resorted to unfair means *i.e.* poaching due to which fish farmers are forced for netting while fish growth is greatly affected by the same. 90.69 % of fishermen groups, reported to receive regular information of market prices while 9.30 % had no regular information of market prices. 100.00 % respondents reported that a small proportion of fish production is mandatory to sell in village market at a predetermined price. 100.00 % of respondents disagree regarding the heavy price paid for acquisition of net. 100.00 % of respondents agree regarding receiving uniform price irrespective of species and size. Only 18.60 % have unavailability of transport facilities while 81.39 % of respondents have good transportation facilities. About 95.34 % respondents had issues of middlemen while only 4.65 % had no issues regarding middlemen.

All the groups faced constraints of heavy weed infestation, conflicts due to multipurpose use of ponds, involvement of middlemen, high netting charges as well as unavailability of transport facility. These constraints need special attention from government sector, so that the overall fish production of the state may be enhanced to optimum level. The findings of this study are similar in the case of fishery co-operative societies and fishermen groups with Halder (2011) in case of fishermen groups with Mohanty *et al.* (2011), in case of SHGs with Singh *et al.* (2012) and in the case of fishery co-operative societies with Nair *et al.* (2007).

(b) Suggestions given by respondents to overcome the constraints

Data presented in (Table 2) depict that majority of the respondents (100.00 %) of fishery co-operative societies gave suggestion that, the executive members of fishery cooperative groups should be changed in every two years by routine, skill training should be organized on regular basis, more educated members may be included in group as well as there should be uniform prices irrespective of species and size. 80.00 % of the respondents submitted their suggestion that loaning procedure should be simple. About 60.00 % respondents suggested improvement of general awareness among the members as well as provision of low cost transport facility.

Among the SHGs, the data presented in Table 2 depict that majority of the respondents (100.00%) of SHGs gave suggestion that, skill training should be organized on regular basis. 95.23 % of respondents suggested that more educated members may be included in group as well as there should be uniform

prices irrespective of species and size. About 90.47 % suggested that loaning procedure should be simple same percentage of the respondents reported that improving general awareness among the members. About 76.19 % of respondents suggested for provision of low cost transport facility while only 61.90 % suggested that executive members of fishery cooperative groups should be changed in every two years by routine.

Among the fishermen groups, data presented in Table 2 depict that majority of the respondents (100.00 %) gave suggestion that timely supply of fingerling/fish seed should be done from co-operative societies and state fisheries development agencies. About 97.67 % of the respondents submitted their suggestion for receiving uniform prices irrespective of species and size. 95.34 % of respondents suggested conducting demonstrations especially on fish production technology same percentage of the respondents reported that fishery department should provide training on fish production technology in the village as well as for prohibition of middlemen from marketing channels should be done. About 90.69 % of respondents suggested provision of low cost transport facility. About 88.37 % of respondents suggested government should provide money for pond cleaning where as 83.72 % of respondents suggested government should provide money "in terms of loan, subsidy etc" for integrated fish farming.

As far as suggestions given by the respondents are concerned, it was noticed that the fishery cooperative societies were interested in regular skill training, change in members in every 2 years, inclusion of educated members and receiving uniform prices of irrespective of shape and size. The SHGs were keen for skill training, inclusion of educated members and simplified loaning procedure. Fishermen groups asked for timely information and training from government, money for pond cleaning, prohibition of middlemen, receiving uniform prices of irrespective of shape and size and timely availability of seed. The findings of this study are similar in the case of fishery co-operative societies and fishermen groups with Halder (2011) in case of fishermen groups with Mohanty *et al.* (2011), in case of SHGs with Singh *et al.* (2012) and in the case of fishery co-operative societies with Nair *et al.* (2007).

CONCLUSION

The important constraints perceived by the respondents were heavy weed infestation, conflicts due to multipurpose use of ponds, involvement of middlemen, high netting charges as well as unavailability of transport facility. The major suggestions given by the respondents to overcome constraints in case of fishery cooperative societies were requirements of regular skill training, change of members in every 2 years, inclusion of educated members and receiving uniform prices of irrespective of shape and size. The SHGs were keen for skill training, inclusion of educated members and simplified loaning procedure, while, fishermen groups asked for timely information and training from government, money for pond cleaning, prohibition of middlemen, receiving uniform prices irrespective of shape and size and timely availability of seed. All the groups faced constraints of heavy weed infestation, conflicts due to multipurpose use of ponds, involvement of middlemen, high netting charges as well as unavailability of transport facility. These constraints need special attention from government sector, so that the overall fish production of the state may be enhanced to optimum level.

Table 1. Constraints faced by Fishery co-operative Societies, Self Help Groups and Fishermen Groups related to production and marketing of fish

S.No.	Particulars		Fishery Co-operative Societies (N=10)	Self Help Groups (N=21)	Fishermen Groups (N=43)
1	Natural calamities like diseases flood etc faced	Yes	1 (10.00)	1 (4.76)	5 (11.62)
		No	9 (90.00)	20 (95.23)	38 (88.37)
2	Heavy infestation of weeds in the ponds	Yes	-	-	5 (11.62)
		No	10 (100.00)	21 (100.00)	38 (88.37)
3	Ponds put to multipurpose use	Yes	10 (100.00)	21 (100.00)	30 (69.76)
		No	-	-	13 (30.23)
4	Multipurpose use of ponds brings out conflicts between owners and non owners	Yes	10 (100.00)	21 (100.00)	-
		No	-	-	43 (100.00)
5	Conflicts hampers the management of pond	Yes	10 (100.00)	21 (100.00)	-
		No	-	-	43 (100.00)
6	Conflicts are intense during dry/summer season	Yes	10 (100.00)	21 (100.00)	-
		No	-	-	43 (100.00)

7	Receivable of regular information regarding prevailing market prices	Yes	10 (100.00)	21 (100.00)	39 (90.69)
		No	-	-	4 (9.30)
8	Proportion of fish production mandatory to sell in village at a predetermined price	Yes	10 (100.00)	21 (100.00)	43 (100.00)
		No	-	-	-
9	Heavy price paid for acquisition of net	Yes	-	-	-
		No	10 (100.00)	21 (100.00)	43 (100.00)
10	Received uniform price irrespective of species and size	Yes	10 (100.00)	21 (100.00)	43 (100.00)
		No	-	-	-
11	Unavailability of transport facilities	Yes	1 (10.00)	1 (4.76)	35 (81.39)
		No	9 (90.00)	20 (95.23)	8 (18.60)
12	Involvement of Middlemen	Yes	-	-	41 (95.34)
		No	10 (100)	21 (100)	2 (4.65)

Note: Figures in parentheses indicate percentage of total number of respondents.

Table 2. Suggestions given by respondents to overcome the constraints

S. No.	Suggestions	Frequency/ %	Rank
I.	**Fishery Cooperative Societies (N=10)**		
1	Executive members of fishery cooperative groups should be change in every two years by routine	10(100)	I
2	Skill training should be organized on regular basis	10(100)	I
3	Loaning procedure should be simple	8 (80)	II
4	Inclusion of more educated members in group	10(100)	I
5	Improving general awareness among the members	6(60)	III
6	Provision of low cost transport facility	6(60)	III
7	Receiving uniform prices irrespective of species and size	10(100)	I
II.	**Self Help Groups (N=21)**		
1	Executive members of SHGs should be change in every two years by routine	13(61.90)	V
2	Skill training should be organized on regular basis	21(100)	I
3	Loaning procedure should be simple	19(90.47)	III
4	Inclusion of more educated members in group	20 (95.23)	II
5	Improving general awareness among the members	19(90.47)	III
6	Provision of low cost transport facility	16(76.19)	IV
7	Receiving uniform prices irrespective of species and size	20 (95.23)	II
III.	**Fishermen Groups(N=43)**		
1	Co-operative societies and state fisheries development agencies should provide improved seeds timely	43(100)	I
2	Government should provide money for pond cleaning	38 (88.37)	V
3	Fishery department Should conduct demonstration especially on fish production technology.	41 (95.34)	III
4	Government should provide money “in terms of loan, subsidy etc” for integrated fish farming.	36(83.72)	VI
5	Fishery department Should provide training on fish production technology in the village.	41 (95.34)	III
6	Provision of low cost transport facility	39(90.69)	IV
7	Prohibition of Middlemen from marketing channels	41 (95.34)	III
8	Receiving uniform prices irrespective of species and size	42(97.67)	II

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GENETIC VARIABILITY AND HERITABILITY STUDIES IN RICE (*ORYZA SATIVA L.*) UNDER SALINE CONDITION

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Abstract: Genetic parameters of variability and heritability of different characters were studied in 17 genotypes of rice. The coefficient of variation was highest for plant height followed by grain yield. The maximum genotypic coefficient of variability and phenotypic coefficient of variability were observed for Na^+/K^+ ratio, straw yield^{-1}, proline content, test weight. The heritability estimates were highest for Na+/K^+ ratio, plant height and chlorophyll content. GA as % over mean were higher for Na^+/K+ ratio, chlorophyll content, proline content, straw yield plant^{-1} and test weight. Results on yield and contributing characters possesses sufficiently high values of heritability and genetic adavance which can be utilized for further improvement of rice and evolving a high yielding saline tolerant variety.

Keywords: Rice, Coastal salinity, Variability, Heritability

INTRODUCTION

Rice (*Oryza sativa* L.) occupies a pivotal place in the Indian agriculture. Rice is also called as the "Grain of Life" because it is not only the staple food for more than 70 per cent of the Indians but also a source of livelihood for about 120-150 million rural households. Rice has been grown under diverse ecological conditions and gets exposed to different environmental stresses like salinity, alkalinity, drought, cold etc. Soil alkalinity and salinity are widespread problems in a number of rice growing countries, particularly in Asian continent. Among the South Asian countries, India has the largest area of about 13.3 million ha, followed by Bangladesh and Sri Lanka. In India alone, 6.7 million ha is characterized by coastal salinity, and inland alkaline and saline soils cover an area of about 6.6 million ha (2.64 million ha saline and 3.96 million ha saline alkaline) (Anon., 2003).

Variation is the basis of plant breeding. As success of any crop improvement programme largely depends on the magnitude and range of variability on the available genetic stock. A critical estimate of genetic variability is a prerequisite for initiating appropriate breeding procedures in crop improvement programmes. Hence, it becomes necessary to spilt over-all variability into its heritable and nonheritable components with the help of certain genetic parameters, which may enable the breeders to plan a proper breeding programme. Therefore, the progress of a population mainly depends upon the amount and magnitude to genotypic variability present in the population. Information of genetic variability among growth as well as yield components in rice has been reported by many workers (Sivasubramanian and Madhava Menon, 1973; Latif and Zamin 1965). In this regard identification and evaluation of salt tolerant genotypes of rice was undertaken with objective to study genetic variability under coastal salinity condition that would be economical to the farmers in increasing their production.

MATERIAL AND METHOD

The material for the present study consisted of 17 genotypes of rice. Field experiment was conducted at Coastal Soil Salinity Research Station, Danti, Gujarat. The experiment laid out in Randomized Complete Block Design (RCBD) with three replications. All cultural practices followed as per the package of practices adopted for irrigated rice. Soil samples from all the three replications collected and they analyzed for parameters such as pH, electrical conductivity using standard procedures.

Observations were recorded on five randomly selected plants in each replication for plant height, days to 50 per cent flowering, productive tillers plant^{-1}, panicle length, spikelets panicle^{-1}, spikelet fertility (%), days to maturity, L/B ratio, proline content, chlorophyll content, Na^+/K^+ ratio, thousand grain weight, harvest index, grain yield and straw yield plant^{-1}. Using data for the above traits were subjected to statistical analysis *viz.*, analysis of variance done by Singh and Chaudhary (1985), Genotypic variance determined by formula given by Burton (1952), coefficient of variation estimated as suggested by Burton (1952), heritability in broad scene was computed by formula suggested by Johnson *et al.* (1955) and expected genetic advance was estimated as suggested by Allard, 1960

RESULT AND DISCUSSION

The coefficient of variation was estimated as suggested by Burton (1952), Expected genetic advance was estimated as suggested by Allard; 1960. Analysis of variance showed highly significant differences due to treatments for all the characters. In general estimates of phenotypic coefficient of

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variability (PCV) were higher than those due to genotypic coefficient of variability for all characters (Table 1). Similar results were also reported by (Das *et al*., 2001 and Majumdar *et al*., 1971). The phenotypic coefficient of variation (PCV) in general was higher than genotypic coefficient of variation (GCV) for all the characters studied indicated the influence of environment on the manifestation of these characters. However, the difference between PCV and GCV was less for the characters *viz*; days to fifty percent flowering, plant eight, L/B ratio, days to maturity and Na^+/K^+ ratio, which indicated low environmental influence and predominance of genetic factors controlling variability in these traits.

The genotypic coefficient of variability was found maximum for Na^+/K^+ ratio followed by straw yield plant^{-1}, proline content and chlorophyll content. The lowest variability was observed for the characters *viz*; days to fifty percent flowering, days to maturity and spikelet fertility percent.

The amount of genetic variation considered alone will not be of much use to the breeder unless supplemented with the information on heritability estimate, which gives a measure of the heritable portion of the total variation. It has been suggested by Burton and Devane (1953) that the GCV along with heritability estimate could provide a better picture of the amount of advance to be expected by phenotypic selection. Since genetic advance is dependent on phenotypic variability and heritability in addition to selection intensity, the heritability estimates in conjunction with genetic advance will be more effective and reliable in predicting the response to selection (Johnson *et al*., 1955). Heritability in broad sense includes both additive and non-additive gene effects (Hanson *et al*., 1956). While, narrow sense heritability includes only additive components (Johnson *et al*., 1955). In the present study, heritability was found highest in all the characters. High heritability were observed for Na^+/K^+ ratio followed by plant height, chlorophyll content, 1000-grain weight, length / breadth ratio, days to maturity and proline content. Burton (1952) suggested that the genetic coefficient of variation along with heritability give clear picture of the amount of advance to be accepted from selection.

In the present studies, the character viz. chlorophyll content grain yield plant^{-1}, proline content, LB ratio, Na^+/K^+ ratio, panicle length and number of productive tillers plant^{-1} had high heritability values but exhibited low genetic advance. Similar result for length of panicle and 1000-grain weight was reported earlier Das *et al*. (2001) and Karthikeyan *et al.*(2010) for grain yield plant^{-1} productive tillers plant^{-1} and panicle length. High heritability coupled with genetic advance can be more useful in selection types with such characters. A relative comparison of heritable estimates and expected genetic advance expressed as percentage of mean will give an idea about the nature of gene action governing a particular character. A comparison of heritability and genetic advance as percentage of mean revealed that chlorophyll content, grain yield plant^{-1}, plant height, proline content, Number of spikelets panicle^{-1} 1000-grain weight, Na^+ to K^+ ratio and straw yield plant^{-1} had high heritability coupled with high expected genetic advance as percentage of mean. Abdul *et al.* (2011) also observed higher broad sense heritability for number of spikelekts per panicle, 1000 rain weight and total biomass. This showed the substantial contribution of additive genetic variance in the expression of these characters. These substantial contribution of additive genetic variance were in confirmation with earlier report of Johnson *et al*., (1955) while number of fertile florets/ panicle and grain yield /plant had high heritability coupled with high expected genetic advance as percentage of mean were also observed by Shivani and Sreeramareddy (2000).

Johnson *et al.*, 1955 suggested that heritability estimates coupled with genetic advance are more helpful than the heritability value alone. This is because heritability estimates subject to genotype environment interactions. Furthermore genetic advance gives extent stability and genetic progress for particular traits under suitable selection system.

On the basis of heritability estimates and expected genetic advance as percentage of mean for different characters studied in the present studies, selection criteria based on chlorophyll content, grain yield plant^{-1}, plant height, proline content, number of spikelets panicle $^{-1}$, 1000-grain weight, Na^+/K^+ ratio, and straw yield plant^{-1} will be useful for further improvement of rice and evolving a high yielding saline tolerant variety.

Table 1. Estimates of different genetic parameters in rice.

Parameter	CHL	DFF	GY	PH	PRO	SPF	SPIKE	TW	LB	Maturity	HI	NA/K	SY	PL	PT
Mean	0.46	98.33	20.41	110.59	0.65	72.74	132.51	23.54	2.77	128.06	47.47	1.77	22.74	22.68	13.07
GCV%	16.63	4.00	12.84	12.03	17.06	5.24	12.87	16.15	9.08	4.40	9.37	40.07	17.26	8.31	9.30
PCV%	17.10	4.48	15.18	12.30	18.40	7.21	14.79	17.09	9.69	4.71	10.21	40.25	18.94	9.44	10.92
Heritability	94.64	79.94	71.57	95.63	85.94	52.85	75.68	89.26	87.82	87.18	84.17	99.13	83.10	77.53	72.60
GA	0.15	7.25	4.57	26.79	0.21	5.71	30.56	7.40	0.49	10.83	8.41	1.45	7.37	3.42	2.13
GA (%mean)	33.33	7.37	22.38	24.23	32.57	7.84	23.07	31.43	17.53	8.46	17.71	82.19	32.42	15.08	16.33
(C.V.)%	4	2	8.1	10.7	6.9	4.9	7.3	5.6	3.4	1.4	4.1	3.8	7.8	4.5	8.2
(C.D.) at 5%	0.03	3.29	2.75	6.36	0.07	6	16.12	2.2	0.16	3.13	3.22	0.11	2.95	1.69	1.58

CHL (µgfw^{-1}) : Chlorophyll content; DFF : Days to fifty percent flowering; GY (g): Grain yield plant^{-1} ; PH (cm): Plant height; PRO (µgfw^{-1}) : Proline content; SPF (%) : Spikelet fertility per cent; SPIKE: Number of spikelets panicle^{-1}; TW (g) : 1000-grain weight; LB : Length to breadth ratio; Maturity : days to maturity; HI (%) : Harvest index; Na^{+}/K^{+} : Na to K ratio; SY(g) : Straw yield plant^{-1}; PL (cm): Panicle length; PT: Productive tillers plant^{-1}.

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EFFICACY OF SOME PLANT EXTRACTS AS A TOXICANTS, ANTIFIDANTS OR GROWTH REGULATORS AGAINST *HELICOVERPA ARMIGERA* (HUBNER)

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Abstract: Fourteen plant extracts namely mango ginger rhizome, bergera leaf, calotropis leaf, tulsi leaf, thusa leaf, dhatura leaf, ipomia leaf, neem leaf, garlic leaf, ginger rhizome, bel leaf, harsingar leaf, neem cake and turmeric rhizome were tested for their toxic effect against the gram pod borer, *Helicoverpa armigera* (Hubner). Each extract was tested in three concentrations (100, 500 and 1000 ppm) incorporated in the semisynthetic diet. The mortality was recorded within three days in the higher concentration of thusa and dhatura leaf extracts and neem cake extracts other plant materials were comparatively slower. The mango ginger rhizome, bergera and tulsi leaf extract were the least effective.

Keywords: Growth regulators, Extract, Toxicant

INTRODUCTION

In recent past research work on many plant species for their insecticidal properties and their possible utilization for the insect pest control attracted the attention of Entomologists. This is mainly due to awareness towards of the environment, which is being polluted by the use of synthetic organic insecticides. The possibilities of their utilization for the pest control have attracted attention in last two-three decades. The research work on properties like toxicant, antifeedant and growth regulators of various plant species has been initiated on many insect species of economic importance. In the last two decades crude and refined extracts of different plant parts, particularly of neem has been used against the defoliators and sucking insects.

For extracting the active ingredient solvents like water, ethanol, methanol, acetone, hexane, petroleum ether, chloroform etc. has been used. In the present investigation ethanol extract of common plant materials were tested against the larvae of gram caterpillar, *Helicoverpa armigera* (Hubner).

MATERIAL AND METHOD

The present investigations were undertaken to test the efficacy ethanol extract of plants on the growth and the development of *Helicoverpa armigera* (Hubner) under laboratory condition in the Department of Entomology College of Agriculture, Gwalior (M.P.).

Extracts of the following fourteen plants were tested against control.

SNO.	Extracts	Botanical name
1	Mango ginger rhizome	*Curcuma ameda*
2	Bergera leaf	*Murraya koiningi*
3	Calotropis leaf	*Calotropis gigantia*
4	Tulsi leaf	*Ocimum adscendens*
5	Thusa leaf	*Thusa oxidentalis*
6	Dhatura leaf	*Dhatura fastusa*
7	Ipomia leaf	*Ipomia carnia*
8	Neem leaf	*Azadirachta indica*
9	Garlic leaf	*Allium sativum*
10	Ginger leaf	*Zingibar officinale*
11	Bel leaf	*Aegel marmelos*
12	Harsingar leaf	*Nyctanthus*
13	Neem cake	*Azadirachta indica*
14	Turmeric rhizome	*Curcuma longa*

Ethanol extracts were prepared from the dried powders of the plant materials. The extracts were dried in Petri dishes, at room temperatures and were kept in the incubators at 60°C for complete drying till constant weight was obtained. The dried material was dissolved in known quantity of ethanol for further use. Semi synthetic diet for mass rearing of *Helicoverpa armigera* (Hubner) was prepared with following contents –

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SNO.	Diet constituent	Quantity required (gm)	Purpose
1.	Bengal gram flour	100.00	Basal food
2.	Agar-agar	12.80	Solidification
3.	Yeast tablet	30.00	Digestion of food material
4.	Wessons salt mixture	7.20	All essential nutrients
5.	Sorbic acid	1.00	Preservative
6.	Methyl paraben	2.00	Anti-fungal agent
7.	Choline chloride	0.72	Fat for better growth
8.	Strepomycine (SO_4)	0.04	Antibacterial
9.	Ascorbic acid	3.20	Increased fecundity
10.	Vitamin drops	1.00ml	Better growth
11.	Formalin (40%)	1.00ml	Antiviral
12.	Distilled water	720.00ml	

The plant extracts were mixed thoroughly @ 100, 500 and 1000 ppm of dried power in 50 ml of semi-solid diet and the mixture was poured in ten specimen tubes (5x 3.5 cm) @ 5ml/tube. The specimen tubes were kept open for eight hours to avoid access of moisture. One, two days old larva was released in each specimen tube and was covered with the perforated lid. Ten such larvae were kept for each concentration and for the control. There were three replications for each treatment. Observations on the mortality were recorded 3, 9, 15 and 21 days after released. Data were subjected angular transformation (arc sine), for statistical analysis.

RESULT AND DISCUSSION

Efficacy of fourteen plant extracts was tested against the larvae of *Helicoverpa armigera* (Hubner). Three concentrations viz. 100, 500 and 1000 ppm of each plant product were tested by mixing them in the artificial diet. The results are described here with-

Toxic effect on the larvae

The data on the mortality of the larvae were recorded 3, 9, 15 and 21 days after release of the larvae. The mortality recorded at different intervals was as under-

Three days after release

Significantly higher mortality was recorded in all the treatment as compared to untreated control. Among various plant materials the maximum plant mortality was recorded in Thusa and Dhatura leaf extracts, which was significantly higher than the rest of the treatments. The mortality in neem cake extract was the next to Thusa and Dhatura leaf extracts and was also significantly higher than the rest of the treatments except neem, Bel and garlic leaf extracts. The lowest mortality was recorded in Mango ginger rhizome extract, which was significantly lower than the rest of the treatments except Bergera leaf extract.

The interaction between plant extracts and their concentrations was also found significant. Significantly higher mortality was in 500 and 1000 ppm of Thusa and Dhatura extracts, 1000 ppm of neem cake, Garlic and Bel leaf extracts. Significantly lower mortality was recorded in 100 ppm of Tulsi leaf extract, which was however, at par with all the three concentration of mango ginger rhizome extract and 100ppm of Bergera leaf extract. The effect of other combination was intermediate. (Table1). Choadhary (1992) reported more mortality in case of dhatura in comparison to neem. Thusa leaf extract has not been tested on the pest so far. Kulat *et al.* (1998) also reported formulation of garlic to be uneffective against Helicoverpa armigera on pigeon pea. The ineffectiveness may be due to the low concentration of the product in the formulation used.

Table 1. Effect of different plant products and their concentrations on the mortality of *Helicoverpa armigera* (3 days after release)

SNO.	Treatment	Per cent larval mortality in concentration of			Mean
		100 ppm	500 ppm	1000 ppm	
1.	Mango ginger rhizome	10.0 (15.30)	10.0 (15.30)	10.0 (15.30)	10.0 (15.30)
2.	Bergera leaf	10.0 (15.30)	20.0 (26.07)	10.0 (15.30)	13.3 (18.89)
3.	Calotropis leaf	20.0 (26.07)	50.0 (45.00)	33.3 (39.15)	34.4 (36.74)
4.	Tulsi leaf	03.3 (06.74)	30.0 (33.00)	60.0 (50.85)	31.1 (30.20)
5.	Thusa leaf	50.0 (45.00)	100.0 (89.09)	100.0 (89.09)	83.3 (74.39)
6.	Dhatura leaf	50.0 (45.00)	100.0 (89.09)	100.0 (89.09)	83.3 (74.39)

7	Ipomia leaf	40.0 (39.15)	30.0 (33.00)	60.0 (50.85)	43.3 (41.00)
8.	Neem leaf	50.0 (45.00)	80.0 (63.93)	70.0 (57.00)	66.7 (55.31)
9.	Garlic leaf	40.0 (39.15)	60.0(50.85)	90.0 (74.70)	63.3 (54.90)
10.	Ginger rhizome	60.0 (50.85)	50.0 (45.00)	80.0 (63.93)	63.3 (54.90)
11.	Bel leaf	30.0 (33.00)	70.0 (57.00)	90.0 (74.70)	63.3 (54.90)
12.	Harsingar leaf	50.0 (45.00)	50.0 (45.00)	70.0 (57.00)	56.7 (49.00)
13.	Neem cake	40.0 (39.15)	70.0 (57.00)	100.0 (89.09)	70.0 (61.75)
14.	Turmeric rhizome	40.0 (39.15)	50.0(45.00)	80.0(63.93)	56.7 (49.36)
	Mean	35.2 (34.56)	55.0 (49.59)	68.1 (59.28)	52.8 (47.81)
	Control	-			10.0 (9.46)

Figure in parentheses are arc sign transformed value

	SEM	C.D (at 5 %)
Control Vs Treatment	(3.14)	(8.84)
Extract	(2.53)	(7.13)
Concentration	(1.17)	(3.30)
Interaction bet-n extract & concentration	(4.39)	(12.36)

Nine days after release

Significantly higher mortality was recorded in all the treatments in comparison to the control. Amongst the extracts, significant higher mortality was recorded in Thusa leaf extract which was significantly higher than the rest of the plant extract except, Dhatura and Neem leaf extract. The lowest mortality was recorded in Bergera leaf extract, which was significantly lower than the rest of the treatments, except mango ginger rhizome. The mortality in the 100, 500 and 1000 ppm was 52.6, 72.1 and 84.3 per cent had significant differences among themselves. The interactions between the concentrations of plant extracts were also significant. Significantly higher mortality was recorded in 500 and 1000 ppm of Thusa and Dhatura leaf extract, along with 1000 ppm of garlic and neem leaf extracts. The lowest mortality was recorded recorded in 100 ppm of Bergera and Tulsi leaf extract, which was significantly lower than the rest of the combinations of the treatments, except in 100 ppm of mango ginger rhizome, garlic, Bel leaf and 1000ppm of Bergera leaf extract (Table 2). Kulkarni (1998) observed that the effectiveness of almost all the extracts increased with the increased concentration in the artificial diet which is natural. Prbhakar *et al.* (1986) observed that the growth regulator activity of neem at 200, 2000 and 20000 ppm in of *Trichoplusia ni* and *Spodoptera exigua.*

Table 2. Effect of different plant products and their concentrations on the mortality of *Helicoverpa armigera* (9 days after release)

SNO.	**Treatment**	**Per cent larval mortality in concentration of**			**Mean**
		100 ppm	**500 ppm**	**1000 ppm**	
1.	Mango ginger rhizome	40.0 (39.15)	50.0 (45.00)	50.00 (45.00)	46.7 (43.04)
2.	Bergera leaf	30.0 (33.00)	50.0 (45.00)	40.0 (39.15)	40.0 (39.72)
3.	Calotropis leaf	50.0 (45.00)	80.0 (63.93)	80.0 (63.93)	70.0 (57.62)
4.	Tulsi leaf	30.0 (33.00)	60.0 (50.85)	80.0(63.93)	56.7 (49.26)
5.	Thusa leaf	60.0 (50.85)	100.0 (89.09)	100.0 (89.09)	86.7 (76.34)
6.	Dhatura leaf	56.7 (48.85)	100.0 (89.09)	100.0 (89.09)	85.6 (75.68)
7	Ipomia leaf	70.0(57.00)	50.0 (45.00)	90.0 (74.70)	70.0 (58.90)
8.	Neem leaf	90.0 (74.70)	90.0(74.70)	80.0 (63.93)	86.7 (71.11)
9.	Garlic leaf	40.0 (39.15)	70.0 (57.00)	100.0 (89.09)	70.0 (59.80)
10.	Ginger rhizome	60.0 (50.85)	70.0(57.00)	90.0 (74.70)	73.3 (60.85)
11.	Bel leaf	40.0 (39.15)	90.0 (74.70)	90.0 (74.70)	73.3 (62.85)
12.	Harsingar leaf	60.0 (50.85)	60.0 (50.85)	90.0 (74.70)	70.0 (58.80)
13.	Neem cake	60.0 (50.85)	80.0(63.93)	100.0 (89.09)	80.0 (67.96)
14.	Turmeric rhizome	50.0 (45.00)	60.0 (50.85)	90.0 (74.70)	66.7 (56.85)
	Mean	52.6 (46.96)	72.1 (61.36)	84.3 (71.42)	69.7 (59.91)
	Control				13.3 (21.15)

Figure in parentheses are arc sign transformed value

	SEM	C.D (at 5 %)
Control Vs Treatment	(3.23)	(9.09)
Extract	(2.60)	(7.33)
Concentration	(1.20)	(3.40)
Interaction bet-n extract & concentration	(4.51)	(12.70)

Fifteen Days After Release

Significant higher mortality was again observed in thusa and dhatura leaf extract with no significantly differences between them. Dhatura leaf and neem leaf extracts were at par with each other. The lowest mortality was in mango ginger rhizome extracts, which was significantly lower than in other treatments, except bergera and tulsi leaf extracts. The mortality in the other treatments was intermediate. Among concentrations significantly higher mortality was observed in 500 and 1000 ppm with no significant differences between them. Significantly lower mortality was recorded in 100 ppm. The interactions between plant extracts and their concentrations were also found significant. Significantly higher mortality was observed in 500 and 1000 ppm of thusa and dhatura leaf extracts and 1000 ppm of garlic leaf extract in comparison to the rest of the combinations. The lowest mortality was recorded in 100 ppm tulsi leaf extract which was significantly lower than the rest of the combinations except 100 ppm of bergera and bel leaf extract and 500 ppm of ipomia and all three concentrations of mango ginger rhizome extracts (Table 3).

Table 3. Effect of different plant products and their concentrations on the mortality of *Helicoverpa armigera* (15 days after release)

SNO.	Treatment	Per cent larval mortality in concentration of			Mean
		100 ppm	500 ppm	1000 ppm	
1.	Mango ginger rhizome	50.0 (45.00)	50.0 (45.00)	50.0 (45.00)	50.0 (45.00)
2.	Bergera leaf	60.0 (50.85)	60.0 (50.85)	40.0 (39.15)	53.3(46.95)
3.	Calotropis leaf	60.0 (50.85)	80.0 (63.93)	90.0 (74.70)	77.8 (63.83)
4.	Tulsi leaf	30.0 (33.00)	60.0 (50.85)	80.0 (63.93)	56.7 (49.26)
5.	Thusa leaf	70.0 (57.00)	100.0 (89.09)	100.0 (89.09)	90.0 (78.39)
6.	Dhatura leaf	60.0 (50.85)	100.0(89.09)	100.0(89.09)	86.7 (76.34)
7	Ipomia leaf	70.0 (57.00)	50.0 (45.00)	90.0(74.70)	70.0 (58.90)
8.	Neem leaf	90.0 (74.70)	90.0(74.70)	80.0 (63.93)	86.7 (71.11)
9.	Garlic leaf	60.0(50.85)	70.0 (57.00)	100.0(89.09)	76.7 (65.65)
10.	Ginger rhizome	70.0 (57.00)	70.0 (57.00)	90.0 (74.70)	76.7(62.90)
11.	Bel leaf	50.0 (45.00)	90.0 (74.70)	90.0 (74.70)	76.7 (64.80)
12.	Harsingar leaf	70.0(57.00)	60.0(50.85)	90.0(74.70)	73.3(60.85)
13.	Neem cake	60.0(50.85)	80.0(63.93)	100.0(89.09)	80.0(67.96)
14.	Turmeric rhizome	50.0(45.00)	70.0(57.00)	90.0(74.70)	68.9(52.26)
	Mean	60.7(52.35)	73.8(62.21)	85.0 (72.61)	73.1(62.16)
	Control				13.3(21.15)

Figure in parentheses are arc sign transformed value

	SEM	**C.D (at 5 %)**
Control Vs Treatment	(3.16)	(8.92)
Extract	(2.55)	(7.19)
Concentration	(1.18)	(3.38)
Interaction bet-n extract & concentration	(4.43)	(12.46)

Twenty one days after release

Twenty one days after release, significantly cumulative mortality was observed in the different treatments in comparision to the control. The maximum mortality was recorded in neem leaf extracts, which was significantly higher than the rest of the plant extracts, except thusa and dhatura leaf extract. The minimum mortality was recorded in bergera leaf, mango ginger rhizome powder extracts which was significantly less than the rest of the extracts, except tulsi and ipomia leaf extracts. The mortality in other treatments was intermediate.

Significantly higher mortality was observed with the increased in the concentrations. The interactions between the extracts and their concentrations were also found significant. Total mortality in 500 and 1000 ppm of thusa, dhatura and bel leaf extracts, 500 ppm of neem leaf extracts 1000 ppm of garlic and neem cake extract was significantly higher than the rest of the treatments. The lowest mortality was recorded in 100 ppm of tulsi leaf extracts, which was significantly lower than the rest of the combinations, except 500 ppm of ipomia leaf extracts. The mortality in the rest combinations of treatment was intermediate (Table 4). Ali Niazee *et al*. (1997) recorded in effective plant materials high mortality occurred in higher dose of 1000 ppm except in mango ginger rhizome powder and bergera leaf powder.

Table 4. Effect of different plant products and their concentrations on the mortality of *Helicoverpa armigera* (21 days after release)

SNO.	Treatment	Per cent larval mortality in concentration of			Mean
		100 ppm	500 ppm	1000 ppm	
1.	Mango ginger rhizome	60.0 (50.85)	60.0(50.85)	60.0(50.85)	60.0(50.85)
2.	Bergera leaf	60.0(50.85)	60.0(50.85)	60.0(50.85)	60.0(50.85)
3.	Calotropis leaf	60.0(50.85)	80.0 (63.93)	90.0 (74.70)	76.7 (63.16)
4.	Tulsi leaf	40.0(39.15)	60.0(50.85)	80.0 (63.93)	60.0(50.85)
5.	Thusa leaf	70.0 (57.00)	100.0(89.09)	100.0(89.09)	90.0(74.70)
6.	Dhatura leaf	70.0(57.00)	100.0(89.09)	100.0(89.09)	90.0 (74.70)
7.	Ipomia leaf	70.0(57.00)	50.0 (45.00)	90.0 (74.70)	70.0 (57.00)
8.	Neem leaf	90.0 (74.70)	100.0(89.09)	90.0 (74.70)	93.3 (79.49)
9.	Garlic leaf	60.0(50.85)	70.0(57.00)	100.0(89.09)	76.7 (65.64)
10.	Ginger rhizome	70.0(57.00)	80.0 (63.93)	90.0(74.70)	80.0 (65.20)
11.	Bel leaf	60.0(50.85)	100.0(89.09)	100.0(89.09)	83.3 (71.54)
12.	Harsingar leaf	70.0(57.00)	70.0 (57.00)	90.0(74.70)	76.7 (62.89)
13.	Neem cake	60.0(50.85)	90.0 (74.70)	100.0(89.09)	83.3 (71.54)
14.	Turmeric rhizome	70.0(57.00)	70.0(57.00)	90.0 (74.70)	76.7 (62.89)
	Mean	**65.7(54.80)**	**77.9(66.24)**	**87.1(74.22)**	**76.9(65.09)**
	Control				**13.3(21.15)**

Figure in parentheses are arc sign transformed value

	SEM	C.D (at 5 %)
Control Vs Treatment	2.87	8.06
Extract	2.31	6.51
Concentration	1.06	3.01
Interaction bet-n extract & concentration	4.00	11.27

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FEASIBILITY OF DRIP IRRIGATION IN MANGO DURING THE LEAN PERIOD OF WATER AVAILABILITY IN WESTERN INDIA

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Abstract: A field experiment was conducted for eight years (2002-2003 to 2009-2010) to compare the performance of drip and surface irrigation methods at different levels during lean period of water availability (*rabi* and summer season) in mango orchard cv. Alphonso. The experiment was laid out in randomized block design with four treatments consisting of two drip levels (0.2 and 0.4 PEF), the recommended practice (three surface irrigations starting from pea size of fruits) and a control with no irrigation. The results indicated that mango trees should be drip irrigated at 0.2 PEF in the areas facing water scarcity to save 30% of the irrigation water with ensued higher yields. The system should be operated at 1.2 kg /cm^2 pressure on alternate day for 40 minutes and 60 minutes during winter and summer months, respectively.

Keywords: Mango, Experiment, Irrigation, Water

INTRODUCTION

Mango is native of Indian subcontinent and grown in almost all continents of the world like North, South and Central America, West and Central Africa, Australia. India is the largest producer of mango accounting for nearly 50 % of the total world production, 34.9% of the area under fruit crops in India and 20.7% of the total fruit production of the country (NHB, 2015). In Indian context, it is an important fruit crop ruling both domestic and export markets. The economy of mango growing belts of Western India is greatly affected and often determined by the mango production. This region experiences very heavy monsoon rainfall from June to September leaving rest of the year mostly dry, resulting in water stress to mango plantations during winter, *rabi* and summer seasons when most of phonological stages *viz.* bud differentiation, flowering and fruiting occur. Such stresses, along with poor nutrient management, incidence of insect/pest and diseases contributes to its low productivity. Optimum moisture level in the soil near the root zone of the crop is critical to agriculture and fruit crops and yield get adversely affected due to excess or deficit water supply. In general, water management assumes paramount importance to reduce the wastage of water and is necessary to increase the Water Use Efficiency (WUE) and ensure equitable water distribution. Irrigation for orchard crops on PEF (Pan Evaporation Factor) eliminates the use of flood irrigation that applies large quantities of water to the soil which in turn tends to leach nitrogen and other nutrients to depths below the root zone. This approach applies lesser amount of water frequently to the root zone based on water evaporation from soil and maintains moisture favouring uptake of nutrients thus avoiding stress and sustaining production in water deficit areas. In this experiment, an attempt was made to study the response of different methods and intensities of irrigation during period of water scarcity (winter, *rabi* and summer seasons) on growth and yield of mango.

MATERIAL AND METHOD

The study area is located at Agriculture Experimental Station (AES), Paria, India which is situated at 22°44' N latitude and 72°94' E longitude at an altitude of 10 m above the mean sea level. The climate of the region is humid, with an average annual rainfall of about 2207 mm distributed from June to September. The minimum and maximum temperature ranges from 9.6 °C to 27°C and 27.2°C to 41.8°C, respectively while relative humidity varies from 57.1 to 92 % during the year. The soils of the area are fine-textured heavy soils classified as Vertic Ustrochrepts. Field experiment was conducted in mango orchard cv. Alphonso planted (10 x10 m) at AES, Paria on 20th November,1988 and the trees were fourteen years old when the experiment started. Four treatments were assessed which included two levels of drip (0.2, 0.4 PEF), recommended practice (three surface irrigations 1st at Pea Stage, 2nd at Marble Stage and 3rd 20 days after second irrigation) and un-irrigated control. The experiment was laid in randomized block design with eight replications. The trees were fertilized with recommended fertilizer dozes (100 kg FYM and 750, 160, 750 g NPK/tree) before the onset of rains. The irrigation treatments were applied after cessation of rains form the month of October and continued up to May. The DRIP system consisted of 50 mm HDPE main line, 16 mm LDPE lateral line at 10 m spacing. Eight drippers with discharge rate 8 lph (litre per hour) were placed

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at 1 m circumference around the tree and the system was operated at 1.2 kg/cm^2 while the surface irrigation treatment was applied at 60 mm depth with flood. The data on tree height (m), plant spread from north-south and east-west (m) and stem girth (cm) were recorded using meter scale and vernier caliper. Mature fruits were harvested from each treatment separately and the weight was recorded with the help of single pan balance and expressed in kilogram. The data obtained on various characters were subjected to Factorial RBD analysis and interpretation of the data was carried out in accordance to Panse and Sukhatme (1985).

RESULT AND DISCUSSION

The data of eight years (2002-2003 to 2009-2010) were pooled and the results are presented (Table 1). The irrigation treatments had a significant effect on plant height and the maximum plant height 9.11 m was recorded in 0.4 PEF irrigation level while un-irrigated trees recorded 6.54 m height at the end of the experiment. The treatments also differed significantly in increasing the plant spread (EW&NS) and plant girth where the maximum spread (11 m) and widest girth (144 cm) was observed in 0.2 PEF irrigation level which were at par with the other two irrigation levels while the un-irrigated trees recorded minimum spread (8.5 m) and least girth (112 cm). Application of optimum irrigation through drip during experimentation effectively increased vegetative growth due to the constant supply of water to the plant. Maintaining soil moisture at optimum level eliminates water stress to the plant resulting in greater vigour (Subramanian *et al.*, 1997). Bhardwaj *et al.* (1995) and Maas and Van (1996) reported that vegetative growth of the plants was found to be influenced favorably by uniform distribution of water in the soil through drip irrigation to young fruit trees. Plant height and canopy spread were significantly better under alternate day drip irrigation over conventional method in aonla (Chandra and Jindal, 2001). The results are in accordance with the findings of Shukla *et al.* (2001) in aonla, Shirgure *et al.* (2004) in acid lime, Sulochanamma *et al.* (2005) and Agrawal and Agrawal (2007) in pomegranate. The eight year pooled data presented in Table 1 reveals that irrigation levels had significant effect on number of fruits/tree and yield (kg/tree). Maximum yield (48 kg/tree) and maximum number of fruits/tree (158) were recorded in 0.4 PEF irrigation levels which were at par with 0.2 PEF and recommended practice of providing three flood irrigations starting from pea size of fruits. The un-irrigated trees recorded 111 (number of fruits/tree) and 31.35 yield (kg/tree). The use of pan evaporation based irrigation achieves additional benefits of conserving water and saving fertilizer besides greater yields. Fruit weight, volume, and peel-pulp ratio increases with the optimum irrigation water supply as water availability influences cell division more than cell expansion but there is no influence on fruit shape (Proietti and Antognozzi, 1996). The results are in conformity with the findings of Biswas *et al.* (1999) who obtained higher yields from drip-irrigated and mulched plots at an IW: CPE ratio of 0.8 compared with those irrigated using a conventional system in papaya. Patil and Patil (1999) observed that guava fruit yield was highest when irrigated at an IW: CPE ratio of 0.8 and Singh *et al.* (2007) revealed 164% greater yields in case of drip as compared to that of ring basin irrigation in guava. Similar findings were reported by Singh and Singh (2005) in papaya and Sharma *et al.* (2011) in guava. In this experiment on yearly pooled basis 128, 256 and 180 mm of water was applied in 0.2 PEF, 0.4 PEF and surface irrigation methods, respectively. These results indicate that 30 % of the irrigation water can be saved if mango plantations experiencing water scarcity are irrigated at 0.2 PEF rather than flood irrigating them three times from pea stage of fruits. Saving in irrigation water (Kanannavar, *et al.*, 2009) and greater net profit due to drip irrigation in banana production has been reported by (Pawar *et al.*, 2010).

Table 1. Effect of different levels of irrigation growth and yield of mango cv. Alphonso.

Treatment	Height (m)	Girth (cm)	Spread (m)	No of fruits/tree	Yield (kg/tree)
I_1 - 0.2 PEF	8.57	144	11.00	142	43.76
I_2 - 0.4 PEF	9.11	143	11.00	158	48.00
I_3 - Three Surface Irrigations 1st at Pea Stage 2nd at Marble Stage	8.35	144	11.00	133	42.23

3rd 20 days after second irrigation					
I_4 - Control	6.54	112	8.5	111	31.35
SEm±	0.11	1.82	0.13	10.7	3.02
CD at 5%	0.33	5.04	0.36	31.50	8.9
CV %	12.16	11.29	10.82	31.50	29.85

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EFFECT OF DIFFERENT TEMPERATURE ON THE ANTAGONISTIC ACTIVITY OF FUNGAL AND BACTERIAL BIO AGENTS

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Abstract: Antagonistic potential of fungal (*Trichoderma harzianum, Trichoderma viride, Aspergillus niger* & *Penicillium oxalicum*) and bacterial bioagents (*Pseudomonas aeruginosa, Pseudomonas putida* & *Pseudomonas florescens*) was studied against three pathogens *i.e. Fusarium oxysporum, Rhizoctonia solani* and *Pythium ultimum* at four different temperature (20°C, 25°C, 30°C and 35°C). Antagonistic potential of all fungal and bacterial bioagents was found to be significantly influenced by different temperature. With regards to effect of different temperature, among all fungal bioagents, *Trichoderma harzianum* resulted maximum percent inhibition of the pathogens followed by *Trichoderma viride, Aspergillus niger* and *Penicillium oxalicum* at 25°C to 30°C. While as bacterial bioagents, *Pseudomonas fluorescens* exhibited their higher antagonistic potential followed by *Pseudomonas putida* and *Pseudomonas aeruginosa* against all three pathogens at highest temperature *i.e.* 35°C.

Keywords: Biological control, Temperature, Fungal & Bacterial bioagents

INTRODUCTION

Soil borne disease caused by *Pythium, Fusarium Sclerotium, Sclerotium, Verticillium, Thielaviopsis* and *Rhizoctonia* inflict serious damage in agriculture crops. Since indiscriminate use of pesticide has done great harm to human, animal, vegetation and environment so use of chemical against these disease is not an effective measure of control, even though , there is also concern about its ill effect on the environment and food quality. Limitation of the use of chemicals have stimulated interest in alternative means of disease suppression such as biological control which could bring about a reasonably good degree of reduction to crop damage by plant pathogens, ensure sustainablity of production, cost effectiveness and healthy ecosystem (Jensen *et al.*, 2000). Though biocontrol agents include all the classes or groups of organism existing in an ecosystem, yet, maximum emphasis for developing biocontrol programmes has invariably gone to fungal and bacterial bioagents. The important genera of fungi studied as biocontrol agents are *Trichoderma, Gliocladium, Aspergillus, Chaeotimum, Penicillium, Neurospora, Fusarium (saprophytic), Rhizoctonia, Dactyella, Arthrobotrys, Catenaria, Paecilomyces, Glomus,* etc. Apart from these, a number of bacterial species/strains have been studies for their plant growth promoting activity and biocontrol potential. These include *Agrobacterium, Actinoplanes, Bacillus, Enterobacter, Erwinia, Pseudomonas, Streptomyces,* etc. Among them currently plant growth promoting rhizobacteria fluorescent Pseudomonads are under intensive research because of their natural occurrence, biocontrol potential as well as plant growth promoting activites. (Mishra, *et al.*, 2001). Having realized the concept of harmful effect of pesticide and exploitation of naturally occurring rhizospheric microbiota against soil borne pathogens the present investigation was aimed to study the effect of different temperature on the antagonistic activity of fungal and bacterial bioagents.

MATERIAL AND METHOD

The present investigation was conducted at Department of Plant Pathology, Janta Vedic College, Baraut, Baghpat U.P.

Source of culture

(a) Causal Pathogens: Isolation of Pathogens (*Fusarium oxysporum, Rhizoctonia solani* and *Pythium ultimum)* done in culture media from diseased plant part collected from field.

(b) Antagonistic fungal and bacterial bioagents: Antagonistic fungal bioagents (*T. harzianum T. viride, A. niger* & *Penicillium oxalicum*) and bacterial bioagents (*Pseudomonas aeruginosa, Pseudomonas putida* & *Pseudomonas fluorescens*) procured from I.G.F.R.I Jhansi.

The efficacy of fungal and bacterial bioagents on radial growth inhibition of test pathogens i.e. *Fusarium oxysporum, Rhizoctonia solani* and *Pythium ultimum* was studied *in vitro*, through dual culture technique at four different temperatures (20°C, 25°C, 30°C and 35°C)

Dual culture technique

The efficacy of fungal and bacterial bioagents on radial growth inhibition of test pathogens *i.e. Fusarium oxysporum, Rhizoctonia solani* and *Pythium ultimum* at different temperature *i.e.* 20°C, 25°C, 30°C and 35°C was studied *in vitro* by dual

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culture technique. Twenty ml sterlized melted PDA was poured in 90 mm diameter petriplate. After solidification mycelial discs having diameter of 5mm were cut from the young culture of fungal bioagents and test fungus with the help of sterilized cork borer. These discs were placed in the Petri plate containing PDA, maintaining the distance of 4cm between the discs of the test fungus. All the Petri plates were incubated for five days at different temperature *i.e.* 20°C, 25°C, 30°C and 35°C. Each treatment had three replications. Radial growth inhibition of test pathogens was measured at an interval of 24h for five days to record different stages of antagonism. The observations on radial growth inhibition of test pathogens *i.e. Fusarium oxysporum, Rhizoctonia solani* and *Pythium ultimum* were recorded after 120 hrs. The percent inhibition over check, noted after 5 days of incubation.

The antagonistic potential of *Pseudomonas* on test pathogens was determined by dual culture technique in a different way. Four discs of the test fungus were placed in the periphery of petriplate at equal distance thereafter the blotting paper discs having the diameter of 10mm dipped in bacterial suspension and placed in the center of petriplates. In check, no blotting paper was placed. These petriplate were incubated at different temperature *i.e.* 20°C, 25°C, 30°C and 35°C for 5days. Each treatment was replicated thrice and the percent inhibition over check, noted after 5 days of incubation the observations on radial growth inhibition of test pathogens *i.e. Fusarium oxysporum, Rhizoctonia solani* and *Pythium ultimum* were recorded after 120 hrs. The percent inhibition over check, noted after 5 days of incubation was calculated by the following formula (Vincet, 1947).

$$I = \frac{C - T}{C} X 100$$

Where,
I = Percent Inhibition
C = Colony diameter in check
T =Colony diameter in treated petriplate.

RESULT AND DISCUSSION

The radial growth inhibition of test pathogens was studied on Potato Dextrose Medium at four different temperature *i.e.* 20°C, 25°C, 30°C and 35°C. The observations thus obtained, are presented in Table 1. It is evident from Table 1 that all fungal and bacterial bio agents varied significantly in their antagonistic potential against *Fusarium oxysporum* at different temperatures. Among the fungal isolates, significantly maximum reduction (1.5 to 2.0) in the growth of the test pathogens was resulted due to *Trichoderma harzianum* followed by *Trichoderma viride* at various temperatures. Though, these fungal biocontrol agents acted more effectively at 25°C to 30°C, exhibiting radial growth minimum 1.5 to 1.7 cm of pathogen and maximum 77.56 to 79.5 percent inhibition over control. It was worthy to note that these bioagents did not visualize any significant difference in their efficacy at different temperature when compared from each other. Remaining other fungal isolates *Aspergillus niger* and *Penecillium oxalicum* grew well at 25°C temperature, thereby resulting in maximum reduction 1.8 and 2.0 cm in growth and 69.5 and 72.0 percent inhibition, respectively over control (Table 1).

Of all the species of *Pseudomonas*, *Pseudomonas fluorescens* showed significantly maximum antagonistic effect against *Fusarium oxysporum* at 35°C followed by 30°C temperature, reducing up to 1.5 and 1.8 cm radial growth and 74.8 and 73.6 percent inhibition respectively over control. The effect of other species of *Pseudomonas viz. Pseudomonas aeruginosa* and *Pseudomonas putida* was also found to be statistically at par with *Pseudomonas florescens* in inhibiting the growth at these temperatures 30°C to 35°C. At the lower ranges of temperatures *i.e.* 20°C and 25°C, these isolates exhibited comparatively least efficacy against the pathogens.

The observations presented in Table 2 show the significant effect of temperature on radial growth inhibition of *Rhizoctonia solani* due to all fungal and bacterial bioagents. Of all the fungal bioagents, maximum reduction (1.6 to 1.7) in growth of pathogens was recorded due to *Trichoderma harzianum* at 25°C to 30°C thereby giving 73.2 to 76.6 percent inhibition respectively over control followed by *Trichoderma viride*. While as the *Aspergillus niger* and *Penecillium oxalicum* exhibited their maximum antagonistic activity at 25°C being resulted 69.6 and 66.1 percent inhibition, respectively. As far as bacterial bioagents is concerned, the highest reduction (1.5) in radial growth was resulted due to *Pseudomonas fluorescens* followed by *Pseudomonas putida* and *Pseudomonas aeruginosa* at 35°C. It was interestingly to note that the efficacy of all the bacterial bioagents at this temperature did not show any significant difference when compared with each other.

It is evident from Table 3 that the growth inhibition of *Pythium ultimum* by all fungal and bacterial bioagents was significantly influenced by fluctuating temperature (20°C to 35°C). Among the fungal bioagents *Trichoderma harzianum* showed significantly maximum reduction (1.4) in the growth of the pathogens at 30°C visualising 78.5 percent inhibition over control. Both bioagents of *Trichoderma i.e. Trichoderma harzianum* and *Trichoderma viride* did not differ statistically in their efficacy at varying temperature when compared to one and another. On the other hand *Aspergillus niger* and *Penecillium oxalicum* inhibited maximum growth (1.9 and 2.0) at 25°C and found to be insignificant in their efficacy from one and another. All bacterial bioagents i.e. *Pseudomonas aeruginosa*,

Pseudomonas putida & *Pseudomonas florescens* resulted in their maximum antagonistic potential against *Pythium ultimum* at 35°C exhibiting 1.3 to 1.5 cm radial growth and 69.6 to 73.5 percent inhibition over control Table 3. Though, efficacy of all these bioagents was found to be statistically at par at this temperature. While at other temperatures, these bio agents reflected comparatively less effectiveness in growth inhibition.

The overall effect of temperature on the antagonistic potential of fungal and bacterial bioagents against the pathogens revealed that all fungal bioagents grew well at 25°C to 30°C and bacterial bioagents grew well at 30°C to 35°C. The results clearly indicate that growth inhibition of *Fusarium oxysporum, Rhizoctonia solani* and *Pythium ultimum* due to fungal and bacterial bioagents is significantly influenced by temperature, *T. harzianum* proved to be most effective against these three pathogens. Besides this there are several instances where the efficacy of fungal and bacterial bioagents has been studied for their antagonistic potential against these soilborne pathogens (Tronsomo and Dennis, 1978; Elad *et al.*, 1983 a, b; Upadhyay and Mukhopadhyay 1983;. Suh *et al.*, 1988; Upadhyay and Rai, 1988.; Sindhu *et al.*, 1997; Saikia *et al*.,1998; Kredics *et al.*, 2000)

Grodona *et al.* (1997) and Srivastava and Mall (2008) reported the antifungal activity of *T. harzianum* against soil borne pathogens with 50 per cent inhibition of all pathogens. The fast growing *Trichoderma* sp. caused more inhibition of the pathogens probably due to mycoparasitism and competition for nutrients. Harman *et al.* (1980, 1989) had suggested that mycoparasitism was the principal mechanism involved in controlling *Pythium* damping off of pea seeds. Hyphal parasitism by *Trichoderma* sp. was also observed *in vitro* by many workers (Dennis and Webster 1971 a, b; Chet and Baker *et al.*, 1981; Lifshitz *et al.*, 1986; Waghmare, 2005).

Trichoderma species are known to produce a number of antibiotics, such as trichodermin, trichodermol, harzianum A and harzianolide (Simon and Sivasithamparam 1988; Dennis and Webster 1971 a). In another study, Gupta *et al*., (1999) successfully used *Pseudomonas florescens in vitro* against *Macrophomina phaseolina* and *Fusarium oxysporum* and found antifungal activity of the strain. The production of hydrogen cyanic acid and indole acetic acid was also recorded under normal growth condition. In another experiment, Velzhahan *et al*.,(1999) isolated several strain of *Pseudomonas florescence* from the rhizosphere of rice plants and tested against *Rhizoctonia solani* causing sheath blight in rice and were found to be effective in inhibiting the mycelial growth of the pathogens. Therefore, it is concluded from the study that *Trichoderma harzianum* can be exploited for the management of soil borne pathogens in place of fungicide without disturbing the ecological balance.

Table 1: *In vitro* effect of temperatures on radial growth inhibition of *Fusarium oxysporum* due to Fungal and Bacterial bioagents

Fungal and Bacterial bioagents	TEMPERATURES							
	20°C		25°C		30°C		35°C	
	*RG (cm)	Inhibition (%)	*RG (cm)	Inhibition (%)	*RG (cm)	Inhibition (%)	*RG (cm)	Inhibition (%)
T. harzianum	1.9	52.4	1.7	79.5	1.5	77.5	2.0	65.3
T. viride	2.0	51.6	1.7	73.5	1.6	75.6	2.1	63.6
A. niger	2.1	47.5	1.8	72.0	2.0	70.2	2.3	60.8
P. oxalicum	2.5	39.5	2.0	69.5	2.2	67.3	2.5	58.1
P. aeruginosa	3.0	25.8	2.4	63.0	1.9	71.2	1.6	72.0
P. putida	3.1	24.1	2.3	65.0	1.8	72.6	1.6	72.6
P. florescens	2.7	34.6	2.2	66.0	1.8	73.6	1.5	74.8
Control	4.1	00.0	6.6	00.0	5.6	00.0	5.9	00.0
C.D. at p = 0.05	0.26		0.25		0.20		0.27	

Table 2: *In vitro* effect of temperatures on radial growth inhibition of *Rhizoctonia solani* due to Fungal and Bacterial bioagents

Fungal and Bacterial bioagents	TEMPERATURES							
	20°C		25°C		30°C		35°C	
	*RG (cm)	Inhibition (%)	*RG (cm)	Inhibition (%)	*RG (cm)	Inhibition (%)	*RG (cm)	Inhibition (%)
T. harzianum	1.9	56.3	1.7	73.2	1.6	76.6	2.0	64.7
T. viride	1.9	56.3	1.7	73.2	1.7	75.2	2.2	61.1
A. niger	2.1	51.1	2.0	69.6	2.2	66.9	2.2	60.5
P. oxalicum	2.4	45.1	2.2	66.1	2.3	65.5	2.4	57.6
P. aeruginosa	2.6	39.8	3.0	53.5	2.1	68.4	1.7	69.4
P. putida	2.5	42.8	2.9	56.0	2.0	69.9	1.5	72.3
P. florescens	2.3	47.3	2.7	59.0	2.0	70.8	1.5	73.5
Control	4.4	00.0	6.6	00.0	6.8	00.0	5.6	00.0
C.D. at p = 0.05	0.18		0.62		0.22		0.22	

Table 3: *In vitro* effect of temperatures on radial growth inhibition of *Pythium ultimum* due to Fungal and Bacterial bioagents

Fungal and Bacterial bioagents	TEMPERATURES							
	20°C		25°C		30°C		35°C	
	*RG (cm)	Inhibition (%)	*RG (cm)	Inhibition (%)	*RG (cm)	Inhibition (%)	*RG (cm)	Inhibition (%)
T. harzianum	1.9	49.5	1.6	72.1	1.4	78.5	1.9	61.9
T. viride	2.0	46.9	1.7	71.1	1.6	76.5	2.0	60.0
A. niger	2.1	45.2	1.9	68.3	2.2	66.8	2.2	57.4
P. oxalicum	2.3	39.1	2.0	65.5	2.3	65.3	2.6	48.3
P. aeruginosa	2.8	26.9	2.7	59.4	2.1	68.2	1.5	69.6

P. putida	2.6	30.4	2.1	64.4	2.0	70.2	1.4	71.6
P. florescens	2.4	37.3	2.0	66.1	1.9	72.1	1.3	73.5
Control	3.8	00.0	6.0	00.0	6.8	00.0	5.1	00.0
C.D. at p = 0.05	0.24		0.59		0.21		0.28	

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STUDY OF SOME PSYCHOLOGICAL CHARACTERISTICS OF BT COTTON GROWER'S

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Abstract: Cotton is major commercial crop of India as well as for Gujarat .bt cotton cultivator posses different psychological characters which affect in knowledge and adoption of new technology so looking to this the present study was conducted in Vadodara district of Gujarat to know the different psychological characters of the bt cotton growers .It is found from the study that Majority of the Bt. Cotton growers (68.12 per cent) had medium level of scientific orientation. Slightly less than three fourth of the Bt. Cotton growers (72.50 per cent) had medium level of innovativeness. Three fourth of the Bt. Cotton growers (75. 63 per cent) had medium risk orientation and a great majority of the Bt. Cotton growers had medium level of overall modernity (85.00 per cent) and economic motivation (82.50 per cent).

Keywords: Crop, Psychological characters, Cotton

INTRODUCTION

Cotton plays a key role in the National economy in terms of generation of direct and indirect employment in the Agricultural and Industrial sectors .Bt cotton, which confers resistance to Lepidopteron pests of cotton, was first adopted in India as hybrid in 2002 after stringent assessment for bio-safety and profitability. In India, after extensive testing of Bt cotton hybrids (with Cry1 Ac gene) in All India Coordinated Cotton Improvement Project (AICCIP) and farmers field, Government of India has approved commercial cultivation of Bt cotton hybrid with effect from 2002 crop season. Agricultural expert said the merits of Bt cotton adoption remain debatable as some have approved it for giving better yield, while some question the claim. "However, I support the adoption of higher yielding crop varieties as most of our cotton farmers are small farmers who need better yields to earn profits. In India Cotton is cultivated in three distinct agro-ecological regions (north, central and south) of the country. The northern zone is almost totally irrigated, while the percentage of irrigated area is much lower in the central and southern zones. The lowest being in the central zone which has nearly 60% of cotton area of our country. Under the rainfed growing conditions rainfall ranges from 900 mm coupled with aberrant precipitation patterns over the years leading to large scale fluctuations in production. In the irrigated tract canal and well irrigation are resorted including the use of micro-irrigation system.USA Australia and Mexico adopted bt cotton in 1996 while China in 1997 and India and Indonesia since 2002. James C (2003).

METHODOLOGY

Cotton is a principal commercial crop of vadodara district and majority of the farmers in the area have undertaken the cultivation of cotton since a very long time. Low productivity of cotton and pest problem is cited as the reasons for the introduction of Bt. Cotton. The present study was designed to know the knowledge level of Bt. Cotton growers in relation to Bt. Cotton and how it is affected by their psychological characteristics. Among 12 talukas of vadodara district, four talukas viz. Karjan, Sankheda, Dabhoi, and Shinor were selected purposively because of more number of farmers cultivating Bt.Cotton in these talukas. The tool used for study was personal interview schedule. Keeping in view the objectives of the study, the interview schedule was developed. 160 respondents from 20 villages were selected and data recorded. Conclusion drowns after the analysis of the data.

RESULT AND DISCUSSION

1. Scientific orientation

It is the degree to which a farmer is orientated to the use of scientific methods in relation to his adoption behavior.

Table 1. Distribution of the bt. cotton growers according to their scientific orientation. N=160

Sr. No.	Category	Frequency	Per cent
1.	Low scientific orientation (Below 18.00 score)	24	15.00
2.	Medium scientific orientation (18.00 to 24.00 score)	109	68.12

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3.	High scientific orientation (Above 24.00 score)	27	16.88
	Total	160	100.00

The data presented in above Table 1 indicate that majority of the Bt. Cotton growers (68.12 per cent) had medium level of scientific orientation followed by 16.88 per cent and 15.00 per cent who had high and low level of scientific orientation respectively. It can be concluded that majority of the Bt.Cotton growers had medium level of scientific orientation. The probable reason might be their high level of education.

2. Innovativeness

Innovativeness as the degree of an individual interest and desire to seek changes in farming technique and to introduce each change in to his own operation as and when found practicable and feasible keeping this fact in view innovativeness was studied and data in this regard are presented in table 2.

Table 2. distribution of the bt. cotton growers according to their innovativeness. N=160

Sr. No.	Category	Frequency	Per cent
1.	Low innovativeness (Below 9 score)	18	11.25
2.	Medium innovativeness (9.00 to 15.00 score)	116	72.50
3.	High innovativeness (Above 15.00 score)	26	16.25
	Total	160	100.00

Data presented in Table 2 reveal that majority of the Bt.Cotton growers had medium level of innovativeness (72.50 per cent) followed by 16.25 per cent and 11.25 per cent who had high and low level of innovativeness, respectively. It can be concluded that majority of the Bt. cotton growers had medium level of innovativeness. The reason might be their high level of education.

3. Risk orientation

The distribution of the Bt. Cotton growers according to their risk orientation is presented in Table 3

Table 3. Distribution of the bt. cotton growers according to their risk orientation N=160

Sr. No.	Category	Frequency	Per cent
1.	Low risk orientation (Below 15.00 score)	14	08.75
2.	Medium risk orientation (15.00 to 19.00 score)	121	75.63
3.	High risk orientation (Above 19.00 score)	25	15.62
	Total	160	100.00

A perusal of the Table 3 revealed that majority of the Bt. cotton growers (75.63 per cent) had medium risk orientation followed by 15.62 per cent and 08.75 per cent who had high and low level of risk orientation, respectively. It can be concluded that majority of Bt. cotton growers had medium level of risk orientation. This finding is in accordance with those of Palaniswamy (1984) and Kosambi (1997)

4. Overall modernity

Modernization is the process by which individuals change from traditional way of life to more complex, technology advanced and rapid changing style of life (Rogers and Sevening, 1969). The above discussion provides a base to believe that modernity of farmer may play an important role in adoption of production technologies. The respondents were grouped into three categories as expressed in Table 4.

Table 4. Distribution of the bt. cotton growers according to their overall modernity. N=160

Sr. No.	Category	Frequency	Per cent
1.	Low overall modernity (Below 22 score)	15	09.37
2.	Medium overall modernity	136	85.00

	(22.00 to 28.00 score)		
3.	High overall modernity (Above 28.00 score)	09	05.63
	Total	160	100.00

The data presented in Table 4 indicate that a great majority of the Bt. Cotton growers (85.00per cent) had medium overall modernity followed by 09.37 per cent and 05.63 per cent who had low and high level of overall modernity respectively.

5. Economic motivation

It is the occupational success in terms of profit maximization and relative value an individual places on economic ends. The distribution of the Bt.Cotton growers according to their economic motivation is presented in Table 5.

Table 5. distribution of the bt. cotton growers according to their economic motivation. N=160

Sr. No.	Category	Frequency	Per cent
1.	Low economic motivation (Below 21 score)	20	12.50
2.	Medium economic motivation(21 to 26 score)	132	82.50
3.	High economic motivation (Above 26 score)	08	05.00
	Total	160	100.00

Data from Table 5 indicate that 82.50 per cent of the Bt. Cotton growers had medium level of economic motivation followed by 12.50 per cent and 05.00 per cent of them who had low and high economic motivation respectively.

It can be concluded that majority of the Bt.Cotton growers had medium level of economic motivation. The probable reason might be that Bt.Cotton growers considered Bt.Cotton crop more remunerative as compared to other crops. This finding is similar to finding reported by Valand (1997).

CONCLUSION

The findings of the study suggest that the majority of the Bt. Cotton growers had medium level of scientific orientation. Slightly less than three fourth of the Bt. Cotton growers had medium level of innovativeness. Three fourth of the Bt. Cotton growers had medium risk orientation and a great majority of the Bt. Cotton growers had medium level of overall modernity and economic motivation.

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SHORT COMMUNICATION

EVALUATION OF FUNGI TOXICANTS AGAINST POWDERY (*ERYSIPHE POLYGONY* DC) DISEASE IN CORIANDER (*CORIANDRUM SATIVUM* L.) AT GWALIOR DIVISION

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Abstract: Five fungicides viz. wettable sulphar, carbendazim, difenoconazole, mancozeb and saaf were tested against powdery mildew (*E. poligoni*) of coriander. The minimum intensity of the diease was recorded in the treatment sulfex (19.86 per cent) followed by score 25.83 per cent, bavistin 29.72 per cent, saaf 31.67 per cent and mancozeb 39.30 per cent.

Keywords: Coriander, Fungi toxicants, Powdery mildew

INTRODUCTION

The coriander (*Coriandrum sativum* L.) is an important spice crop of India and its seeds (Fruits) and leaves are extensively used. Since very old time. Coriander is being used as a natural additives in cooking added to food in order to improve its appearance, flavor, texture as well as appetite.

It is an aromatic annual herb of 1-2 ft. height having diploid chromosome (2n=22) belonging to the family umbelliferae. The coriander crop is grown for its aromatic and fragrant leaves and fruits. The pleasant aroma is due to an essential element called at d- Linalol or coriandral. The essential oil content ranges from 0.1 to 1.3 percent in dry seeds. Besides essential oil, the seeds of coriander contain 18-21 percent fatty oils which are used in the cosmetic industries. The dried ground fruits used as condiment and are invariably a major constituent of curry powder employed for flavoring curries, soups, and sauces and in confectionery .

The coriander is a native of the Mediterranean region and is extensively grown in different countries such as India, USSR. Mexico, Poland, Hungary, U.S.A. India is the largest producer in the world. It alone accounts an area of 11, 3382 hectares with an annual production of about 37571 metric tons. The major coriander growing states are Rajasthan, Madhya Pradesh, Andhra Pradesh, Gujrat and Tamil Nadu, In Madhya Pradesh Several coriander cultivars are grown but the common ones are UD-1, CS-2, UD-2, UD-373 UD-436, CS-4, CS-208, G-5365 and R C R-41. Madhya Pradesh alone account an area of 37147 hectares with the average production of 9374 metric tons in 2002-2003. In M.P., coriander is grown in Gwalior, Guna, Indore and Mandsor districts.

The coriander crop suffers from different diseases which is one of the limiting factors in its production. Mukherji and basin (1986) listed twenty fungal pathogens and bacterium causing different diseases. Out of these some common fungal diseases are tem gal (*Protomyces macrosporus*), powdery mildew (*Erysiphe polygoni* DC), wilt (*Fusarium oxysporum f.sp. coriandrii*), stem rot (*Rhizoctonia* spp.) and blight (*Alternaria* spp.). Out of these powdery mildew is a very destructive disease and cause losses by deteriorating the quality of the seed and reducing the yield . It is observed that once the parasite establishes itself in the field it takes quits a heavy toll from year to year.

MATERIAL AND METHOD

The present investigations were undertaken at the research farm, College of Agriculture, Gwalior (M.P.) during 2003-04 of powdery mildew of coriander to examine the influence the five fungicides. Sulfex (Wettable sulphur), Bavistin (Carbendazim) score (Difenoconazole) Dithan M 45 (Mancozeb) and Saaf (Carbendazin + Mancozeb) were evaluated for their efficacy @ 0.1, 0.3, 0.1, 0.2 and 0.2 per cent respectively. The fungicides spraying were done thrice at the interval of 10 days starting from 60 days after sowing. The design was randomized block design (RBD) replicated four times, 6 treatments, keeping plot size 2x1.5 m and maintained the distance row to row and plant to plant 25x10 cm. and the varieties were selected susceptible local. Seed rate was @12kg ha^{-1} and date of sowing 25-11-2002. The harvesting time was 15-03-2003.

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RESULT AND DISCUSSION

Evaluation of fungi toxicants agaist powdery mildew of coriander

Five fungicides viz. wettable sulphar, carbendazim, difenoconazole, mancozeb and saaf were tested against powdery mildew (*E. poligoni*) of coriander. The minimum intensity of the diease was recorded in the treatment sulfex (19.86 per cent) followed by score 25.83 per cent, bavistin 29.72 per cent, saaf 31.67 per cent and mancozeb 39.30 per cent. All the tested fungicides were found significantly superior over control (75.83 per cent) in respect of disease control and yield enhancement. The sulfex was found significantly superior over all treatments in respect of disease control. Score was also significantly superior over Saaf and mancozeb in respect of disease control but was at par in respect of yield enhancement. Similar result has been reported by Srivastava *et al.* (1971), Keshwal *et al*. (1979) and Raju *et al.* (1982).

Table 1. Evaluation of fungi toxicants agaist powdery mildew of coriander

S.No.	Treatments	Concentration (%)	Average PDI	Yield (q/ha)	% increase in yield over control
T_1	Sulfex (Wettable sulphur)	0.3	9.86 (26.38)**	8.75	48.3
T_2	Bavistin (Carbendazim)	0.1	29.72(32.95)**	7.60	28.8
T_3	Score (Difenoconazle)	0.1	25.83(30.41)**	8.17	38.5
T_4	Dithan M-45 (Mancozeb)	0.2	39.30(38.79)**	7.40	25.4
T_5	Saaf (Carbendazim 12% + Mancozeb 63%)	0.2	31.67(34.23)**	7.70	30.5
T_6	Control	-	75.83(60.62)	5.90	-
	SEM ±	1.79		0.57	
	CD (at 5%)	3.83		1.28	
	CD (at 1%)	5.30		1.80	

The treatments in parenthesis are common name of the respective fungicides.
Data in parenthesis are angular transformed values on which the statistical analysis is based.
** Significant at 1 %

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