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CONTENTS

BIO MANAGEMENT OF *MELOIDOGYNE INCOGNITA* INFECTING *LYCOPERSICON ESCULENTUM* MILL

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ABSTRACT

Studies were conducted in earthen pots to determine the efficacy of the promising bio-control agents *viz. Aspergillus fumigatus, Trichoderma harzianum* (fungi) and *Bacillus subtilis* (bacteria) on the growth parameters of tomato. The maximum shoot length was recorded in the plant treated with Bs_1, followed by root length with Bs_2, shoot fresh weight with Bs_1, root fresh weight with Bs_2, shoot dry weight with Bs_2 and root dry weight with Bs_2. No significant difference ($P < 0.05$) was recorded in *T. harzianum* treated plants. The highest suppression in galls formation was 84.71% treated with *T. harzianum* and without any significant difference in Bs2 treated plants (84.31%, $P < 0.05$). The highest percent reduction in number of egg-masses/root was recorded with *T. harzianum* (89.02%) and followed by all the treatments as compared to inoculated control plants. Tomato infected with *M. incognita* and treated with indigenous strains of *T. harzianum, A. fumigatus* and with bacterial strains *B. subtilis* (Bs_1 and Bs_2) showed increase in plant growth and reduced root galls and egg masses formation. The growth promoting effects were apparently due to the solubilizing activity of the bio-control agents applied in the soil and also the suppressive effect on root knot nematode by reduction in hatching, interference with host recognition and invasion as the bacteria envelop or binds the root surface with carbohydrate–lectin, mortality of infective juveniles by producing toxic metabolites and nematicidal components and alteration of specific root exudates which control nematode behavior.

Key words: *Bio-management, Meloidogyne incognita, Lycopersicon esculentum.*

Tomato (*Lycopersicon esculentum*) is one of the most potential vegetable crops. Due to its high nutritive values, it is cultivated worldwide in tropical, subtropical and warm temperate soil. Among various pests and diseases, it is severely infested with one of the major nematode pest root knot nematode *(Meloidogyne incognita)* which cause severe yield loss (27.21%) and quality (Jain *et al.*, 2007). Root knot nematodes are sedentary endoparasite. The infection starts with root penetration of second stage juveniles (J_2) hatched in soil from egg encapsulated in egg masses laid by females on the infected roots (Barker *et al.*, 1985). Management of root knot nematode is being done by using the chemical nematicides but because of highly toxic and potentially polluting chemicals used, various workers suggested other control measures in view of the need to replace such chemicals preferably with bio-control agents and botanicals (Oostendrop and Sikora, 1989). Several attempts have been made to use *Trichoderma* spp. to control plant parasitic nematodes. Reduction in egg production by female *M. arenaria* has been studied in soil treatment with *T. harzianum* and *T. koningii* (Windham *et al.*, 1989). The present investigation was undertaken to evaluate the bio-control potential of indigenous strains of fungi (*Aspergillus fumigatus, Trichoderma harzianum*) and bacteria (*Bacillus subtilis*) of Meerut region against root-knot nematode, *M. incognita infesting tomato.*

MATERIALS AND METHODS

Root-knot Nematode Culture

The egg masses were removed (Southey, 1970) from the monoxenic culture of *M. incognita*

and thoroughly washed 3-4 times in sterile water and poured onto moistened double layer tissue paper on petri plates, filled with sterile water and incubated at 28±2°C in BOD for 2 days for emergence of juveniles (IJ_2). The cultured juveniles in petri plates were collected daily in a beaker of 500 ppm streptomycin sulphate solution for 8 hours adopting the method as given by Dasgupta and Gangully (1975). This solution was removed by sterile water and stored at 15°C in BOD until the juvenile suspension was homogenized. Estimation of J_2/ml was calculated by average of five counting in counting dish. The juveniles were inoculated @ 2J_2/g soil by making the 3-4 holes of about 4cm depths around the seedling stem and after inoculation holes were filled and irrigated as needed.

Bioagents Culture

Plants were carefully uprooted with soil adhering to their roots and the soil was collected by vigorously shaking roots from the rhizosphere in a lastic bag. The soil dry weight was taken after drying t 100°C for 2 days adapting the procedure of Khan al., (2000). One gram sample of dry soil was added 9ml sterile distilled water further 1 ml of this solution s diluted with 9ml of distilled water in separate tube, ution diluted 10 times to 10^{-1}; one ml of this tube ed with 9ml of distilled water, the solution diluted times to 10^{-2} and subsequently diluted till 00,000 times to 10^{-7} in the same manner. Each ure was shaken (200 rpm) for 30 minutes using r (Tarsons, India). Further, 0.5 ml aliquots of priate serial dilutions were spread on the Potato se Agar media for fungi and on Nutrient Agar for bacteria culture in petri dishes. Petri dishes ing agar media and soil suspension were ed at 28°C in BOD for 7 days and grown were again sub cultured in the same media cation.

tion of Inocula of Bio-agents

he screened antagonistic isolates of bacteria, phytotoxic fungi were multiplied freshly on plates of PDA and NA media, respectively. spension was prepared with the help of a atula by adding 10 ml of sterilized distilled ture plates. Number of spores/cells in one ml of the suspension was determined using haemocytometer and the colony forming units (cfu/ml) for fungal suspension was estimated as $2x10^6$ CFU/ml and for bacterial suspension it was $2x10^8$ CFU/ml. For soil application cell suspension was used in two steps as dip treatment of seedling roots with 1% carboxy methyl cellulose solution as adhesive and all the seedlings were dipped for 5 minutes and further fresh cell suspension applied in the soil with dry substrate. For fungi, conidia were multiplied on sorghum and millet seeds (sterilized and soaked in 5% sucrose solution) for 10 days at 25±2°C and for bacteria 40ml cell suspension mixed in 200 g talc powder and both were applied @ 0.2% (w/w) in prepared soil of experimental pots (Hassan and Gowen, 2006).

Preparation of Soil and Seedlings

Soil was collected from the agricultural fields of Ch. Charan Singh University, Meerut. The texture of the soil was determined and characterized as sandy loam with pH range 7.2-8.3. Soil, used in the experiment, was sterilized at 15 lb pressure for 30 minutes in vertical autoclave. Experimental seedlings of tomato (NSC, foundation seed) were raised in seedling trays in prepared sterilized soil amended with compost manure (2:1). Twenty-one days old tomato seedlings were transplanted in 15 cm diameter earthen pots filled with sterilized soil and treated with prepared inocula of *M. incognita* juveniles @ 2 J_2/g soil and bio-agents (fungi and bacteria). All the treatments were replicated four times and irrigated as needed and after 60 days of nematode inoculation plants were uprooted carefully. The data were collected and statistically compared with infested and healthy control plants on plant length, plant fresh and dry weight, number of galls per root, number of egg-masses per root and Root Knot Indices (Table 1, 2).

RESULTS AND DISCUSSION

The treatments conducted on tomato plants were found significant to reduce root knot nematode and improve other plant parameters *viz.* length of root and shoot, fresh and dry weight of root and shoot. The observations revealed that the plant growth

parameters were recorded maximum as shoot length (36.56) in Bs_1, root length (26.42) in Bs_2, shoot fresh weight (21.30) in Bs_1, root fresh weight (9.93) in Bs_2, shoot dry weight (14.62) in Bs_2 and root dry weight (2.66) in Bs_2, without any significant difference ($P < 0.05$) in *T. harzianum* treated plants (Table 1).

The maximum suppressive effect on root-knot nematode infestation as percent reduction in galls formation over control was recorded highest (84.71%) in *T. harzianum* and without any significant difference ($P < 0.05$) in Bs2 (84.31%) treated plants. The percent reduction in number of eggmasses/root was also observed maximum in *T. harzianum* (89.02%) and followed without any significant difference ($P < 0.05$) by all the treatments as compared to inoculated control plants (Table 2).

In present study, tomato plants grown in the pots infected with *M. incognita* and treated with indigenous strains of *T. harzianum*, *A. fumigatus* and with bacterial strains *Bacillus subtilis* (Bs_1 and Bs_2) showed increase in plant growth and reduced root galls and egg-masses formation. The growth promoting effects were apparently due to the solubilizing activity of the microorganisms applied in the soil. The microorganisms used, *viz. B. subtilis* (Dube and Podile, 1987; Khan and Tarannum, 1999), are potential solubilizers of phosphate. They convert the non-utilizable forms of phosphates present in the soil into forms which are readily utilized by plants (Gaur, 1990). Phosphorus is one of the most important major plant nutrients and is essential for plant growth and vigour (Pierre, 1938). The growth of tomato plants in bio-agents treated plants are in agreement with the study of Rao *et al.* (1998) who studied that the application of *T. harzianum* on brinjal plants increased the plant height and weight with least root galling. Sankanaryanan *et al.* (2000) also reported that treatment with *T. harzianum* resulted in improved growth of tomato plants infested with *M. incognita*.

Table 1: Efficacy of bio-control agents on plant growth parameters of tomato plants infested with *M. incognita*

Treatments	Plant length(cm)			Plant fresh weight(g)			Plant dry weight(g)		
	Shoot	Root	Total	Shoot	Root	Total	Shoot	Root	Total
Control (Healthy)	32.40^b	19.82^b	52.22	18.47^b	6.33^b	24.8	11.30^b	1.82^b	13.12
Control (Infested)	23.21^c	15.12^c	38.33	11.05^c	5.12^c	16.17	8.22^c	1.55^b	9.78
N + *T. harzianum*	34.21^a	26.12^a	60.33	20.42^a	8.63^a	29.05	12.34^b	2.42^a	14.76
N + *A. fumigatus*	31.45^b	24.30^a	55.75	19.65^b	7.21^b	26.86	11.62^b	2.21^a	13.83
N + Bs_1	36.56^a	25.35^a	61.91	21.30^a	9.11^a	30.41	14.20^a	2.40^a	16.6
N + Bs_2	35.32^a	26.42^a	61.74	20.20^a	9.93^a	30.10	14.62^a	2.66^a	17.28
LSD ($P < 0.05$)	2.56	2.79	-	3.51	2.25	-	2.45	0.853	-

N = Nematode; Bs = Bacillus subtilis, the figures followed by different letters are significantly different from each other at 5% level.

Table 2: Efficacy of bio-control agents on number of galls and egg-masses of *M. incognita* on tomato plants

Treatments	No. of galls / root system	Reduction in galls formation(%)	No. of eggmasses/root system	Reduction in eggmasses formation(%)	RKI
Control (Healthy)	-	-	-	-	-
Control (Infested)	184.75^{c}	-	175.5^{b}	-	4^{b}
N + *T. harzianum*	28.25^{a}	84.71	19.25^{a}	89.04	1^{a}
N + *A. fumigatus*	37.25^{b}	79.84	25.5^{a}	85.48	1^{a}
N + Bs_1	31.25^{a}	83.09	20.75^{a}	88.18	1^{a}
N + Bs_2	29.0^{a}	84.31	20.5^{a}	88.32	1^{a}
LSD ($P < 0.05$)	7.70	-	8.25	-	0.396

N = Nematode; Bs = Bacillus subtilis, the figures followed by different letters are significantly different from each other at 5% level.

The study revealed the suppressive effect of bio-agents on root-knot nematode by reduction in hatching, interference with host recognition and invasion as the bacteria envelop or binds the root surface with carbohydrate-lectin (Oostendorp and Sikora, 1990), mortality of infective juveniles by producing toxic metabolites and nematicidal components (Spiegel *et al.*, 1991; Becker *et al.*, 1988) and alteration of specific root exudates which control nematode behaviour (Racke and Sikora, 1992).

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EVALUATION OF PLANT EXTRACTS AND COW URINE DISTILLATE FOR CONTROL OF SOIL-BORNE PHYTOPATHOGENS

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ABSTRACT

Aqueous extract of *Azadirachta indica*, *Datura metel*, *Cassia lunata* and *Calotropis procera* were screened for their antimicrobial activity using disc–diffusion method. These were tested against four phytopathogenic fungi, *Alternaria solani*, *Fusarium oxysporum*, *Fusarium graminearum* and *Helminthosporium oryzae*. The susceptibility of microorganisms of these plants was compared with each other. The maximum antimicrobial activity expressed in terms of zone of inhibition was shown by *Calotropis procera* followed by *Azadirachata indica* and *Datura metel*. This study significantly validates the use of plants as potent antifungal agents.

Key words: *Antimicrobial, plant extract, inhibition.*

The plant fungal diseases are traditionally been controlled by chemical fungicides. In view, of the high cost of chemicals and their hazardous consequences the use of plant extracts gained importance during last three decades (Fowcett and Spenser, 1970; Mitra *et al.*, 1984, Grainge and Ahmed, 1988; Jesper and Ward 1993). The use of chemicals increase the yield of crop, but their constant use induced the resistantce in target organism and contaminate the environment (Okigbo 2004; Carvalho, 2004). A possible alternative to solve such problems is the use of plants which are able to produce antifungal substance (Miranda, 2003). These fungicides are environmentally safe nonphytotoxic and have minimum adverse effect on physiological process of plant (Isman, 1989). The extract of the plant materials can be easily prepared by the farmers (Okigbo and Nameka, 2005). On the basis of efficacy of plant extracts present study was conducted to find out the effective plant products and cow urine distillate to control the soil borne phytopathogens.

MATERIALS AND METHODS

Collection of materials: The plant materials used in this study were collected from the MIET Campus, Meerut and identified and authenticated by the Department of Botany, C.C.S. University, Meerut (Table1). The organism used in the present study, *Fusarium oxysporum* and *Fusarium graminearum* were isolated from chickpea rhizosphere, *Alternaria solani* and *Helminthosporium oryzae* from brinzal- and rice-infected leaves respectively by serial dilution method (Table 2). Isolates were confirmed by the character given by Von Arx (1974).

Preparation of extracts: Extraction of different plants in water was done by surface sterilization of plants by washing with 70 % ethanol and finally with sterilized water to remove the traces of ethanol. These were then, crushed and extracted in 20 ml of sterilized water.

Assay of antifungal activity of plant extracts: 5 ml of prepared aqueous extract of each plant/part was mixed with 10 ml of molten Czapek dox agar medium in a petriplates separately and agitated thoroughly to mix the extract homogeneously. Control sets were prepared similarly using 5 ml of sterilized distilled water instead of extract. Fungal disc (5 mm diameter), cut

from periphery of 7 days old culture of *Alternaria solani*, *Fusarium oxysporum*, *Fusarium graminearum* and *Helminthosporium oryzae* were inoculated aseptically in each assay. Fungi toxicity was calculated and recorded in terms of % inhibition of mycelial growth. Experiments were repeated twice and each set contained three replicates.

Assay of antifungal activity of cow urine distillate: The cow urine distillate was prepared and was mixed in 12 ml of molten Czapek dox agar medium in petriplates. Control sets were prepared similarly using 1 ml of sterilized distilled water instead of urine. Fungal disc (5mm diameter), cut from 7 days old culture of *Alternaria solani*, *Fusarium oxysporum*, *Fusarium graminearum* and *Helminthosporium oryzae* were inoculated aseptically in each assay. The plates were incubated at 28°C for 5 days. Fungi toxicity was calculated and recorded in terms of % inhibition of mycelial growth.

Determination of minimum inhibitory concentration (MIC) level: Minimum inhibitory concentration (MIC) was determined using different concentration (0.5- to 5 ml) of extracts. 1 ml cow urine and 1 ml plant extract mixed in 15 ml of molten Czapek dox agar in petri plates. Control sets were prepared similarly using 2 ml of sterilized distilled water instead of urine and plant extract. Fungal toxicity was calculated in terms of percent inhibition of mycelia growth over by using the formula.

$$\text{of Inhibition} = \frac{\text{Diameter of control colony - Diameter of treated colony} \times 100}{\text{Diameter of control colony}}$$

ESULTS AND DISCUSSION

Extracts of all the plants (*Azadirachta indica*, *tura metel*, *Cassia lunata* and *Calotropis cera*) and combined effect of cow urine distillate plant extract used in this study were tested against phytopathogenic fungi (*Alternaria solani*, *rium oxysporum*, *Fusarium graminearum* and *inthosporium oryzae*) to determine their ngal activity. Different concentration of plants and nbined concentration of cow urine distillate were against pathogenic fungi. Minimum inhibition tration (MIC) was measured to determine the antifungal activity. The inhibition effects of the medicinal plant used on pathogenic fungi were presented in Table 3 whereas combined effect of plant extract and cow urine distillate is shown in Table 4.

In this study, six concentrations of the aqueous *Azadirachta indica* leaf extracts suppress the 84% growth of *Helminthosporium oryzae* and approximately 60% of *Alternaria solani* and *Fusarium graminearum* but it is less effective against *Fusarium oxysporum*. Same pattern of inhibition was also observed when aqueous fruit extract of *Datura metel* was used as antifungal agent. It shows 82.8%, 57%, 77.7% and 64.2% inhibition of *Alternaria solani*, *Fusarium oxysporum*, *Fusarium graminearum* and *Helminthosporium oryzae*, respectively. The effect of extract of *Calotropus procera* leaves at 5 ml concentration showed 43.0% inhibition on *Fusarium oxysporum*, 78.0% on *Alternaria solani*, 87.5% and 75.0% inhibition on *Fusarium graminearum*, *Helmeinthosporium oryzae*, respectively. Fresh flower of *Calotropus procera* showed maximum inhibition activity against *Fusarium oxysporum*. The extract of *Cassia lunata* is effective upto 70.3% in case of *Fusarium oxysporum* while lowest 22.2% inhibition of *Fusarium graminearum* recorded in 5 ml concentration after 7 days of incubation (Table 3).

The inhibition of fungi respectively done to the positive effect of inhibition of both plant extract & cow urine distillate, both were used for inhibition against all four test organisms. 1ml urine distillate with 1 ml *Azadirachta indica* leaf extract shown about 71% and 64% inhibition of *Fusarium oxysporum* and *Fusarium graneium* and 50% inhibition of *Helminthosporium oryzae* but above combination were not effective against *Alternaria solani*. Cow urine distillate was also used against *Alternaria solani*, *Fusarium oxysporum*, *Fusarium graminearum* and *Helminthosporium oryzae* with *Datura metel* in 1ml concentration but above combination were not more effective and showed only 50% inhibition of all four organism. Cow urine distillate showed maximum inhibition 90% of *Alternaria solani* and 80% of

Table 1: List of plants collected and used in this study

Scientific Name	Common Name	Family	Parts used
Azadirachata indica	Neem	Solanaceae	Leaf
Datura metel	Datura	Meliaceae	Flower
Cassia lunata	Aak	Apocynaceae	Leaf
Calotropis procera	Amaltas	Fabaceae	Flower

Table 2: List of pathogenic fungi isolated

Fungus	Host	Plant Part	Symptoms of disease
Alternaria solani	Brinzal	Leaf	Scattered dark brown spots
Fusarium oxysporum	Chick pea	Leaf	Yellow straw colored
Fusarium graminearum	Chick pea	Leaf	Yellow brown colored
Helminthosporium oryzae	Rice	Leaf	Brown spots

Table 3: Antifungal activity of plant extracts obtained from different plants

Plant extracts	Concentration	% Inhibition of fungi			
		Alternaria solani	*Fusarium oxysporum*	*Fusarium graminearum*	*Helminthosporium oryzae*
Azadirachata indica	0.5ml	22.2	30.9	26.8	54.5
	1.0ml	38.8	32.1	31.7	59.0
	2.0ml	44.4	38.9	34.1	65.9
	3.0ml	50.0	33.9	53.6	70.4
	4.0 ml	50.0	37.5	56.0	75.0
	5.0ml	55.5	39.2	58.5	84.0
Datura metel	0.5ml	45.7	34.2	33.3	25.0
	1.0ml	60.0	42.8	33.3	32.1
	2.0ml	62.8	42.8	44.4	38.5
	3.0ml	71.4	42.8	55.5	46.4
	4.0 ml	74.2	45.7	61.1	57.1
	5.0ml	82.8	57.1	77.1	64.2
Cassia lunata	0.5ml	27.2	37.0	20.0	13.8
	1.0ml	33.3	40.7	25.0	13.8
	2.0ml	39.3	51.8	27.5	16.6
	3.0ml	44.4	55.5	30.0	16.6
	4.0 ml	45.4	62.9	30.0	19.4
	5.0ml	57.5	70.3	22.2	22.2
Calotropis procera	0.5ml	12.5	10.0	55.0	54.5
	1.0ml	43.0	20.0	60.0	61.3
	2.0ml	62.5	26.6	70.0	63.6
	3.0ml	62.6	33.5	75.0	65.9
	4.0 ml	71.8	36.6	77.5	70.4
	5.0ml	78.0	43.0	87.5	75.0

Table 4: % Inhibition of mycelial growth by cow urine distillate and plant extracts.

Plant extracts	% Inhibition of fungi			
	Alternaria solani	*Fusarium oxysporum*	*Fusarium graminearum*	*Helminthosporium oryzae*
Cow urine distillate and *Azadirachata indica*	26.6	70.6	63.3	48.1
Cow urine distillate and *Datura metel*	63.1	43.3	50.0	42.1
Cow urine distillate and *Cassia lunata*	60.0	36.6	47.3	42.1
Cow urine distillate and *Calotropis procera*	77.1	33.3	60.5	44.7

Fusarium graminearum with 1ml *Calotropus* flower (Table 4).

These result are in agreement with Singh *et al.* (1990) who found that the growth of four pathogens (*Fusarium* spp., *Rhizoctonia solani*, *Sclerotium rolfsii* and *Sclerotinia sclerotioum*) was also inhibited in the same manner where as in *Cicer arietinum*, the growth was inhibited in liquid medium by extract of leaf trunk bark an oil from the *Azadirachta indica* tree. Alam *et al.* (2007) reported the similar finding that the extract of *Calotropus procera* showed high inhibitory effect against *Fusarium oxysporum*. Basem and Khalil (2007) also reported only 24% inhibition of *Fusarium oxysporum* with different plant extracts. Bansal and Rajesh (2000) found that *Calotropus procera* completely inhibit the growth of *Fusarium solani*.

Jabin (2003) reported that cow urine has inhibitory activity against *Fusarium semitectum* and cow urine distillate mixed with leaf extract of *Calotropus* spp. completely (100%) inhibited the mycelial growth of the pathogen. Cow urine distillate has been proved to be inhibiting to the mycelial growth of *Fusarium oxysporium, Fusarium solani* thatcause wilt in different plants Basak and Lee, (2002).

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OCCURRENCE OF POTENTIAL BIOAGENT, *DACTYLARIA EUDERMATA* DRECHSLER, A PREDACEOUS FUNGI PRESENT AT OUR HOME.

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ABSTRACT

***Dactylaria eudermata* is one of the most important predaceous fungi occurring widely in different types of soil. The fungus produces the hyphal bails and network compound. When moving nematodes pass through such hyphal bails, they are captured by sticky substances present on the bails. Such nematodes struggle violently to escape the capture but they are usually entangled at several places of their body. They absorb the nutrients and finally kill the nematodes. These predaceous fungi were predominantly present in the soil samples which were collected from the different places in the campus of B.H.U. (Varanasi).**

Key words: *Dactylaria eudermata, nematodes, soil samples*

Predaceous fungi are not rare. They are very common fungi present in soil, decomposing vegetable matter, rotting wood etc. and there are many others that are if not quite so wide spread, at least reasonably easy to find. The search for predaceous fungus hampered by the fact that they can not be seen without a microscope, so that it is impossible to tell whether they are present in a particular sample of material without laboratory examination.

Fresenius (1852) first reported *Arthrobotrys oligospora* as a common habitat of organic plant debris .The predatory relationship of *Arthrobotrys oligospora* was reported by Zopf (1888). He observed that actively motile nematodes could be caught in the hyphal nets of *A. oligospora*. He noted that the fungal hyphae penetrated the cuticle of captured nematodes and the mycelium invaded and developed inside the nematode body. Drechsler (1937) reported the constricting and non constricting ring producing fungi associated with sticky knobs.

Dactylaria eudermata is one of the important predaceous fungi occurring widely in different soils. The fungus produces hyphal bails and network compound in which nematodes are entangled. The fungus disables the struggling nematodes by intruding one or more globose infective bodies from which assimilative hyphae are then extended to invade the fleshy interior from head to tail. At first the assimilative hyphae are not clearly visible in the body. Later the degenerating material has been largely absorbed, the assimilative hyphae become more clearly visible. With ample of nourishment being obtained through destruction of many nematodes, the fungus produces conidiophores and conidia in three to four days. This fungus is so effective that it captures large number of nematodes within few days.

MATERIALS AND METHODS

Five hundred gram soil samples each from botany department, vegetable farm, central library lawn, rice field of Banaras Hindu University , were collected separately in fresh polythene bags. *Dactylaria eudermata* predaceous fungi were isolated on maize meal and rabbit dung agar by using the technique described by Duddington (1955) with some modification. About 500 mg of soil from each sample was scattered in the bottom of a sterile plate Sterilized melted and cooled maize meal agar were poured in each plate to cover 2/3 area of plate. The other 1/3 area of a plate was poured rabbit dung agar. The plates were incubated at room temperature (25-

30oc) for observation. The saprophytic nematodes already present in the soil sample multiplied rapidly and served as prey for predaceous fungi. There is no need to incorporate nematode from outside in the plate. The incubated plates were routinely observed after seven days of incubation for the *Dactylaria eudermata* under stereoscopic microscopic.

RESULTS AND DISCUSSION

The frequency of the fungus appeared in the sample indicates that this fungus was predominant in soils collected from central library lawn, vegetable farm and in botany department (Table 1.) however it was less frequent in soil collected from rice field. The mango leaf litter recorded least colonies of *D. eudermata*. The other soil samples did not record the presence of fungus.

The colonies of *D. eudermata* appeared in same plates preying on living nematodes as pre dominant fungus in some of the samples. The slides of the fungus were prepared in lacto phenol and cotton blue and measurements of conidiophores, conidia and hyphae were recorded (Table 2). The type of spores, conidiophores and hyphal nets helped in the identification of the fungus. The fungus was identified using the key given by Cooke and Godfrey (1964) and Drechsler (1950).

Table 1: Frequency distribution of *Dactylaria eudermata* in different soil and manure samples:

SLNo.	Different soil samples	Presence or Absence of *Dactylaria eudermata*
1.	Mango leaf litter (MPP)	+
2.	Compost	—
3.	Botany Department	++++
4.	Vegetable farm	++++
5.	Rice Farm	++
6.	Dairy Farm	—
7.	Central Library	+++

++++ = Excellent source +++ = Good source

++ = Fair source + = Poor source

— = Absent

Table 2: Size of conidia and conidiophore of *D. eudermata*

Nematophagous fungi	Conidial size (µm)		Length of conidiophore (µm)	Conidiophore width (µm)		Chlamydospore
	Length	Width		Base	Tip	
D.eudermata	27.81 to 55.62	15.45 to 33.99	350 to 450	6 to 9	2.5 to 3.5	Absent

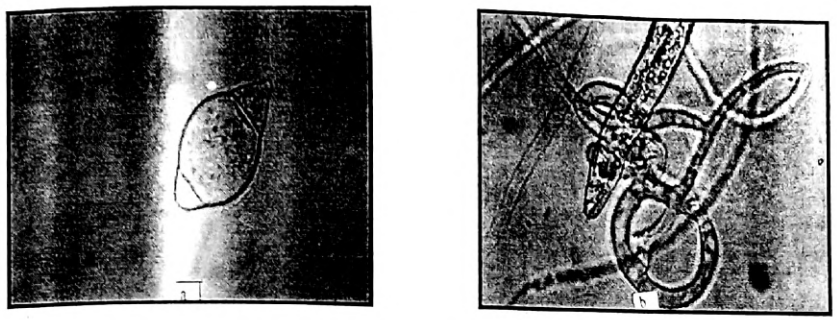

Fig. (a) Conidia of *Dactylaria eudermata*

(b) Hyphal bails produced in which nematode is trapped

Taxonomy of the *Dactylaria eudermata*: The taxonomic position and chief characters of *D. eudermata* are given as bellow:

Kingdom : Myceteae
Division : Amastigomycota
Subdivision : Deuteromycotina
Form class : Deuteromycetes
Form subclass : Hyphomycetidae
Form order : Moniliales
Form family : Moniliaceae
Form genera : Dactylaria
Form species : D. eudermata

Mycelium spreading, vegetative hyphae colorless, septate at moderate interval, mostly 1.8 to 7.5 micrometer wide. The conidiophores hyaline, erect, usually containing 2 to 8 septa, commonly 350 to 450 micrometer long 6 to 9 micrometer. wide at the base, tapering gradually upward to a width of 2.5 to 3.5 micrometer near the tip, simple or some times branched at the distal end, consequently producing a single conidium or occasionally bearing 2 to 3 conidia in loose capitate arrangement. Conidia colorless, septate ellipsoidal or ovoid or broadly turbinate, broadly rounded at the tip, somewhat tapered proximately, truncate at the base mostly 27.81 to 55.62 micrometer long and 15.45 to 33.99 micrometer wide.

ACKNOWLEDGEMENT

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EFFECT OF REDUCED TILLAGE AND FIRB ON CROP YIELD AND WATER PRODUCTIVITY OF RICE CROP

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ABSTRACT

The present field study was carried out during two consecutive years (2005-06) to study the effect of tillage and crop establishment methods on performance of rice crop. It was observed that tillage options had no effect on total tillers, panicle length, number of grains/ panicle and straw yield, whereas the plants attained more height under conventional tillage than reduced tillage (RT). The effective tillers were more under CT than RT. The test weight, grain yield and harvest index were found to be significantly higher under RT than CT. The rice crop performed better on raised beds than flat bed planting for all the characters .The water requirement was found maximum (20 % less) under FIRB planting and maximum under C.T. The water productively was maximum under FIRB planting.

Key words: *FIRB Planting, Reduce Tillage, Rice, Growth and yield characters.*

The oldest and most effective farm activity of man is the tillage. It is done with the purpose to improve physical condition of the soil so as to favour the root development of the plants which results in better yield of crops. The practice of intensive tillage by the farmers is based on their staunch adherence to the old belief "the more you till, the more you harvest". Now it is the era of conservation agriculture which means adoption of practices that improves the efficacy of the use of natural resources including water, oil, input and people. The conservation agriculture, includes the reduction in tillage operations, furrow irrigated raised bed (FIRB) planting system, precision land leveling, use of leaf colour charts, crop residue management and crop diversification.

The water requirement for growing rice is a core issue as it involves larger amount of water and large cost of irrigating rice fields when the water table is going down. The furrow irrigated raised bed (FIRB) planting method has been found a success preposition for water saving, potential to reduce the cost of cultivation, to improve the productivity of rice and wheat crops and hence considered as a viable alternate for addressing sustainability issues of rice-wheat cropping system. Based on the experience and benefits of reduced tillage and FIRB planting method already achieved else where, it was thought to explore the possibilities of introduction of these resources conservation technologies. With this in view, the present investigation was carried out to compare the reduced tillage and FIRB planting with conventional tillage for growing rice crop in western U.P.

MATERIALS AND METHODS

The present field experiment was conducted at agriculture farm of J.V college, Baraut, Distt. Bagpat (U.P) during two consecutive years (2005-06) . The experiment was laid out in randomized block design with 3 treatments of tillage and crop establishment methods each with 4 replications. These treatments were conventional tillage, reduced tillage and FIRB planting. The rice variety sown was Pusa Basmati-1 which was developed and released in 1989 at I.A.R.I. New

Delhi by a cross between Pusa 150 and Karnal local. The crop was grown following wheat with a seed rate of 40 kg/ha in nursery. Nitrogen, phosphorus and potash were given @ 80,60 and 50 kg/ha, respectively. Total quantity of phosphorus and potash and 25% of total nitrogen was applied at the time of land preparation whereas 50 % of total nitrogen was applied after 30 to40 days of transplanting and rest 25% was given at the panicle initiation stage. These nutrients were supplied through urea (174 kg/ ha), single super phosphate (375 kg/ha) and murate of potash (84 kg/ha). The weedicide, Butachlor 15% granular @ 30-40 kg/ha was broadcasted in the field after 3-4 days of transplanting. The seedlings were transplanted in the last week of June. The irrigation water was maintained 3-5 cm up to dough stage and drained out 10 to15 days before harvesting.

The observations were recorded on different characters of growth and yield, and water used. The data collected on different characters were statistically analyzed using the technique of analysis of variance and the significance of differences between treatment means were tested by estimating the critical difference at 5 % level.

RESULTS AND DISCUSSION

Growth and Yield characters

The average plant height, numbers of total tillers and effective tillers in rice crop have been presented in table 1 whereas the yield contributing characters and grain yield, biological yield and harvest index in table 2 for two years data.

The plant height in first year averaged 7.1, 45.7, 91.8 and 91.8 cm at 30, 60 and 90 days after sowing and at harvest under conventional tillage; 6.9, 44.8, 91.0 and 91.0 cm at these stages of growth under reduced tillage and the corresponding height the plants attained at these growth stages under FIRB planting had been 8.0, 47.0, 92.8 and 92.8 cm, respectively (Table 1). The plant height increased by 0.23, 1.28, 1.53 and 9.0 cm / day during first 30, 31 - 60, 61 – 90 and after 91 days to harvesting under conventional tillage whereas the increase in plant height under reduced tillage averaged 0.23, 1.26, 1.60 and 9.0 cm/ day during the different stages of growth and the corresponding increase in plant height under FIRB planting had been 0.26, 1.30, 1.52 and 9.0 cm / day. This indicated that plants grow at a very slow rate in the first month of age and maximum growth was observed during third month after which there was no increase in plant height. This was true for different tillage and crop establishment methods during both the years. The data on plant height further indicated that the plants grown on raised beds (FIRB) attained significantly more height than on flats and this was true for the crop of both the years. The results of this study on plant height supported the findings of Singh et al (2002) who reported that height of rice plants on raised beds was more than in puddled plots.

The average numbers of total tillers/m^2 area in rice at different stages of growth were found to be nearly equal under conventional and reduced tillage at all stages of growth in both the years. However, the number of total tillers under FIRB planting were more than on flat planting (Table 1). Statistical analysis of the data have indicated that total tillers / m^2 area on raised beds were significantly higher than on flat whereas the total tillers under conventional and reduced tillage were at par statistically at all stages of growth in both the years. It was further observed that tillering rate was maximum during first month and third month of transplanting under all the tillage and crop establishment methods. This was true in the crop of both years and there was no tillering after 90 days of the crop growth. The number of effective tillers (panicle bearing tillers) at maturity were found to be 363.0, 358.2 and 364.5 under CT, RT and FIRB, respectively in the first year whereas the corresponding values were 362.7, 358.0, and 364.0 during second year. Thus 1.9, 3.1 and 3.4 % of the total tillers failed to mature and bear panicles under CT, RT and FIRB planting systems, respectively in the first year with almost similar percentage of total tillers failed to bear panicles in the second year. The perusal of data on this character has shown that the tillers which emerged around 90 days of transplanting the crop failed to bear panicles. On subjecting the

data to statistical analysis, it was found that the number of effective tillers were significantly less under RT. Singh et al (2002) also reported more number of earheads/m^2 on raised beds than conventional planting.

The panicle length averaged 21.7, 22.8 and 24.0 cm under CT, RT and FIRB, respectively in the first year crop whereas the corresponding values for average panicles length in second year were recorded to be 21.3, 22.6, and 24.1 cm which were almost same as in first year. Thus the panicle length was found to be more by 2.3 and 2.8 cm in first and second year for the rice plants under FIRB planting than on flat with conventional tillage and puddling. The length of panicles for the crop under reduced tillage with puddling was intermediate to that of plants grown on FIRB and conventional tillage. Thus reduced tillage was found better than conventional tillage for increased panicle length of more than one centimeter. However, the tillage and crop establishment methods did not influence significantly the panicle length. Singh et al (2002) found longer earheads on raised beds than on flat planting.

The number of grains per panicle averaged to be 49.0, 49.0 and 51.2 under CT, RT and FIRB, respectively, in the first year and almost similar number of grains / panicle were observed in the second year crop. Thus the number of grains / panicle was almost equal under two tillage options whereas under FIRB planting the numbers of grains / panicles were significantly more than flat bed planting system. This was attributed to greater length of panicle under FIRB planting than on flat. The average weight of 1000 grains was found to be 24.9 , 25.7 , 26.8 gm for the sample drawn from the crop grown under CT , RT and FIRB planting system , respectively in first year. It was thus observed that the grains were heavier under FIRB planting method by 1.9 and 1.1 gm than under CT and RT system, respectively. The test weight of 1000 grains was also found more by 1.5 and 0.7 gm under FIRB than on CT and RT, for the crop of second year. Thus the FIRB planting produced significantly heavier grains than flat bed planting method of rice cultivation. The test weight was also found to be significantly higher under reduced tillage than under conventional tillage. Singh et al (2002) also found higher test weight of rice grains on raised beds than on flat planting.

The grain yield under conventional tillage with puddling was found to be 52.0 and 51.5 q / ha in two years and under reduced tillage it was 52.9 and 52.7 q / ha in two years whereas on FIRB planting the grain yield averaged 55.7 and 54.7q/ha in two years. Thus FIRB planting produced higher yield by 3.7 and 3.2 q /ha in two years compared to conventional method of tillage, whereas it was higher by 2.8 and 2.0 q / ha in two years than reduced tillage. Statistically, these differences were found to be highly significant, The grain yield was significantly higher by 1.0 q/ha under reduce tillage than under conventional tillage. The higher grain yield under FIRB system was due to higher values of yield contributing characters under this system viz. longer panicle length, more number of grains / panicle and heavier grains were produced by transplanting the rice seedlings on raised beds than on flat bed planting. Similar results of higher grain yield of rice on raised bed have been reported by Gupta et al (2002), Singh et al (2002), Jat and Sharma (2005) and Gupta et al (2006), whereas Singh et al (2005) found significantly lower rice grain yield on raised beds than of puddled transplanted rice.

The straw yield under reduced tillage (75.1 and 74.2 q/ha in two years) was similar to the conventional tillage (75.2 and 74.4 q/ha) whereas it was 76.3 and 74.2q/ha under FIRB planting. Statistically, the straw yield did not differ significantly due to tillage and crop establishment methods. The biological yield which is the sum of the grain yield and straw yield also showed the same trend with respect to tillage and crop establishment methods as that of its both the components. When the data were subjected to statistical analysis, it was found that biological yields under FIRB planting system was significantly higher than on flat planting. But the two tillage options did not affect it. The harvest index was found to be higher (42.1 and 42.4 % in two years) for the rice crop under FIRB planting than on flat

Table 1: Effect of different tillage and crop establishment methods on plant height and tillering of Rice.(Two years Averages)

T & CE *Methods	Plant height (cm) at DAS**			
	30	60	90	Harvest
FIRB	7.8	46.9	92.5	92.5
RT	6.8	44.8	90.8	90.8
CT	7.0	45.6	91.5	91.5
CD 5%	0.22	0.35	0.44	0.44
	Total tillers/m²			
FIRB	105.6	190.0	376.5	376.5
RT	103.7	183.8	369.6	369.6
CT	104.8	184.8	369.6	369.6
CD 5%	1.8	4.6	2.36	2.36
	Effective tillers/m²			
FIRB	-	-	-	364.2
RT	-	-	-	358.1
CT	-	-	-	362.8
CD 5%	-	-	-	2.41

T & C E*=Tillage and crop establishment Methods, DAS**=Days after Sowing

Table 2: Effect of different tillage and crop establishment methods on yield contributing characters and yield of rice.(Two years Averages)

Tillage & CE methods	Panicle length (cm)	Grains/ spike (no)	Test wt. (gm)	Grain yield (q/ha)	Straw yield (q/ha.)	Biological yield (q/ha)	H.I. (%)
FIRB	24.1	51.2	26.3	55.2	75.2	130.4	42.2
RT	22.7	49.0	25.5	52.8	74.6	127.4	41.4
CT	21.5	48.8	24.7	51.75	74.8	126.5	40.9
CD 5%	-	0.94	0.44	0.50	0.92	1.30	0.31

system under CT (41.1 and 40.8 % in two years) and RT (41.3 and 41.5 % in two years). The harvest index indicates the percentage of grain yield to that of biological yield and hence the harvest index was significantly higher under FIRB planting as well as under reduced tillage because of higher grain yield.

Water Productivity

The data have shown that maximum water was required to irrigate rice crop under conventional tillage (9264 m^3/ ha) and minimum water under FIRB method (7358 m^3/ ha). Thus the water requirement under FIRB planting system was less by about 1900 m^3/ ha (20 % less) than conventional method of tillage and reduced tillage also. The water productivity was also found to be higher under FIRB planting (0.75 kg grain produced / m^3 water) than conventional and reduced tillage. Both the tillage options had nearly the same water productivity. Thus growing of rice under FIRB planting was found more economical in terms of water required compared to conventional and reduced tillage. Lesser water requirement and higher productivity under FIRB planting of rice crop have also been replaced by Gupta et al (2002), Jat and Sharma (2005) and Gupta et al (2006).

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EFFECT OF DIFFERENT SUPPLEMENTS AND SUBSTRATE FOR THE MAXIMUM PRODUCTION OF OYSTER MUSHROOM (*PLEUROTUS SAJOR CAJU*) (FR.) SING

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ABSTRACT

One substrate namely wheat straw with the pulses flour viz. arhar flour and gram flour singly as well as in combination were used for the maximum yield of *Pleurotus sajor caju*. The maximum yield (575.50gm) was recorded in wheat straw + arhar flour + gram flour followed by wheat straw + arhar flour (550.00gm) and wheat straw + gram flour (547.50gm).

Key words: *Pleurotus sajor caju, substrate, amendment, yield.*

India is a country of the varied topography, climate and agricultural resources. The vast amount of agricultural wastes coupled with climatological diversity can be successfully exploited for the cultivation of oyster mushroom. Mushroom cultivation is gaining commercial importance in recent years due to increasing global demand for high quality protein and are rich in vitamins and minerals. Mushrooms contains 35-47% protein (dry weight basis) which is higher than in vegetables and fruits and is of superior quality. Pasturised wheat straw is most suitable substrate for cultivation of oyster mushroom and support its maximum production. Supplementation of mother substrate with various substances of organic and inorganic nature, prior to spawning, for enhancement of yield of this mushroom species has been widely used. Various oil seed meals and cakes, powered pulses, wheat and rice bran have been supplemented with substrate to get better result, (Upadhyay and Verma 2000). Keeping this view in mind the present study was under taken for the effect of different supplements and substrate for the maximum production of oyster mushroom (*Pleurotus sajor caju*).

MATERIALS AND METHODS

This experiment was conducted in National Academy of Biological Sciences and Rural Development, Jhusi, Allahabad (A Research wing of Society of Biological Sciences and Rural Development) during 2010. Wheat straw were dried and cut into 3-4 cm. long pieces and were soaked 10-12 hours in fresh water. To avoid the any type of infection bavistin 7.0 gm and formalene (40%) 125ml/ 100 liter were added. Wheat straw then taken out from water and were spread over cemented floor to drain out excess water.

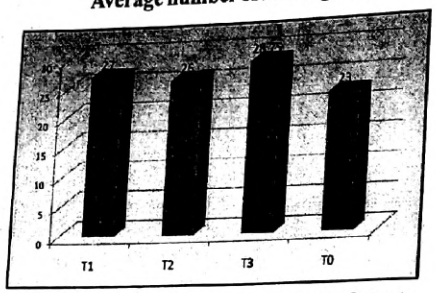
The supplements, gram flour and Arhar flour were treated in autoclave at 15 lbs psi for 20 minutes. The polythene bags (of size 35x50 cm.) of 100 gauge thicknesses were filled with wheat straw and supplements were added @ 2% dry weight basis in 4 layers. After each layer spawning was done with the grain spawn @ 2% per bag containing 1 kg. dry substrate. For this purpose spawn was obtained from Mushroom Research Laboratory of Chandra Shekar Azad University of Agriculture and Technology, Kanpur. All the treatments were replicated three times. These spawned bags were kept in cropping room where the temperature ranged 20-25^{0}C alongwith 60-65% relative humidity. After 15 days of spawning, the bags were completely colonized by mushroom mycelium and polyphyne were removed. The first flush of sporophores were harvested after 25th days of spawning and the second and third flushes were harvested on 32nd and 40th days of spawning respectively. The yield of fruiting bodies on fresh weight basis was recorded.

RESULTS AND DISCUSSION

The maximum number of fruiting bodies (28.75) were found on wheat straw + combination of arhar and gram flour followed by wheat straw + arhar flour (27.00) and on wheat straw + gm flour (26.00). The maximum production of yield (575.50gm) was also recorded in wheat straw + arhar flour + gm flour followed by wheat straw + arhar flour (550.00 gm) and in wheat straw + gram flour (547.50gram). Maximum production were noted in combination of wheat straw + arhar flour + gram flour may be due to additional supply of nutrients and energy from flours. Similar observation were made by Bano (1971), Jandaik (1974), Schisler and Sinden (1963) and Yogesh Kumar *et. al* (1991).

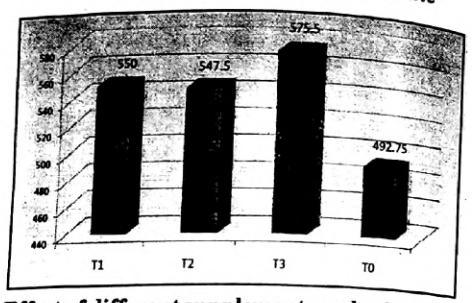
T_1 – Wheat straw + Arhar Flour
T_2 – Wheat Straw + Gram Flour
T_3 – Wheat straw + Arhar Flour + Gram Flour
T_0 – Control

Average number of fruiting body



Effect of different supplements and substrate on the fruiting body of Oyster mushroom

Average yield in gm/1 kg dry substrate



Effect of different supplements and substrate on the yeild of Oyster mushroom

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PRODUCTION POTENTIAL AND WATER PRODUCTIVITY OF WHEAT CROP UNDER REDUCED TILLAGE AND RAISED BED PLANTING

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ABSTRACT

The present field experiment was conducted during rabi season of two consecutive years (2005-07) on growing of wheat under different tillage and crop establishment methods. The wheat plants attained more height, more number of total tillers and effective tillers , longer spikes with more number of grains/spike, higher test weight, higher grain yield and higher harvest index under FIRB plating than Flat bed planting. The plants attained less height under reduced tillage (RT) but had more number of tillers (total and effective) and higher test weight under RT than conventional tillage (CT) whereas the spike length, number of grains/spike, grain yield and harvest index were not influenced by tillage options. The water requirement was found minimum but water productivity was maximum under FIRB than under flat bed planting.

Key words : *FIRB Planting, Reduce Tillage, Wheat, Growth and yield characters.*

A consortium known as rice-wheat consortium (RWC) of south Asia for Indo-gangetic plains (IGP) has been very successful in sustaining the green revolution through adoption of resource conservation technologies (RCT's) for growing wheat after rice (Hobbs, 2001). A range of RCT's is under development and evaluation under the umbrella of RWC for RW system as well as other cropping systems. Conservation agriculture has proved an important breakthrough for sustaining productivity, natural resources base and economic growth of farmers. The goals of increasing profitability of farmers with high food production and its nutritive value to match population growth and environmental sustainability can be achieved by incensing productivity of crops as well as water and nutrient use efficiency of cropping systems, reducing atmospheric and ground water pollution and reversing the decline of soil organic matter. Considering water availability and increasing labour cost as well as scarcity of labour, it needs to adopt alternate method of establishing crops. Sowing of wheat following rice or sugarcane ratoon is delayed which adversity affects its productivity. Zero tillage or reduced tillage and bed planting techniques have been considered to reduce the turn around time and to establish good wheat crop without loss in yield. These RCT's have gained considerable interest of researchers and farmers to adopt them for addressing productivity and sustainability issues of rice – wheat cropping system. However , the result of earlier experiments are contradictory regarding the effect of reducing tillage intensity and raised bed planting of wheat crop. Keeping in view of this, the present investigation was planned to study the effect of tillage and crop establishment methods on growth and production potential of wheat crop and its water requirement.

MATERIALS AND METHODS

The present study was carried out at agricultural farm of J.V. College, Baraut, District – Bagpat (U.P) during 2 years (2006-07). The soil of the experimental field was of loam texture , nearly neutral in reaction (pH – 7.2) , moderately fertile and well drained with 0.4 % organic carbon. The wheat variety sown was PBW 343 which was developed at Punjab Agricultural University in 1996. The crop was grown after harvesting rice under different tillage and crop establishmentmethods. These were (i) conventional tillage flat bed planting (ii) reduced tillage flat bed planting and (iii) conventional tillage raised bed planting known as FIRB (Furrow Irrigated Raised Bed). In conventional tillage four ploughings were done with tractor whereas in reduced tillage only two ploughings were done. In FIRB method, the crop was sown on beds with 15 – 20 cm heights having widths of about 50 cm and furrow width 25 cm. The seeds were sown in two rows on each bed on top of the bed. The seed rate was kept 100 kg/ ha. Four irrigation were given. Nitrogen, Phosphorus and Potash were given @ 120 kg , 50 kg and 40 Kg/ ha respectively. The sources of these nutrients were urea (261 kg / ha), single super phosphate (312 kg / ha) and Murate of Potash (67 kg/ha). The sowing was done in last week of Nov. and harvesting was done in 1st week of April in both the years. The observations were recorded on different characters of growth and yield and water used. The experiment was laid out in randomized block design under three treatments of tillage and crop establishment methods (Conventional tillage, reduced tillage and FIRB) each with four replications. The data collected on different growth and yield attributes were statistically analysed by analysis of variance with testing the significance of differences by estimating critical difference at 5 % level.

RESULTS AND DISCUSSION

Growth and yield of wheat

The average values of different growth characters for two years data viz. plant height and total tillers at 30, 60, 90 days after sowing as well as at maturity and the effective tillers (Spike bearing) have been presented in table 1 whereas the grain yield and its contributing characters like spike length, number of grains per spike, test weight, grain yield, straw yield, biological yield and harvest index have been presented in table 2.

The height of wheat plants averaged 7.7, 7.3, and 8.0 cm under CT, RT and FIRB planting system in the first year at 30 days after sowing whereas the values in second year were 7.5, 7.0 and 7.8 cm, respectively for different tillage and crop establishment methods. The plants attained the height of 44.5 and 44.4 cm, 43.0 and 42.9 cm and 45.8 and 44.9 cm in two years under CT, RT and FIRB planting methods at 60 days. Thus the plant height increased by 0.25, 0.24, and 0.26 cm / day during first month of age in first year, under CT, RT and FIRB method of sowing wheat. The rates of increase in second year were nearly equal to that of the first year under all the tillage and crop establishment methods. The wheat plants attained the maximum height up to 90 days after sowing and there was no increase in plant height after 90 days of sowing the crop. The rate of increase had been 1.22, 1.19 and 1.26 cm / day under CT, RT, and FIRB methods during 30 – 60 days and 1.55, 1.56, 1.57 cm / day under these methods of sowing during 60 – 90 days in first year. The rate of increase in plant height had been almost equal at different stages of growth in both the years under different tillage and crop establishment methods. It was thus evident that plant growth was low during first month of life and maximum during 60 – 90 days. The growth data indicated that the plants on raised beds attained significantly more height than on flat beds in both the years. The plants under RT attained significantly lesser height than under CT. Singh et al (2002a) also reported that plant height was more under conventional tillage than under zero tillage.

The data presented in Table 1 on total number of tillers at different stages of growth in wheat crop have indicated that under reduced tillage the average

number were little more than conventional tillage at all stages of growth. This was true for the crop grown in two years. It was further noted that FIRB planting system produced significantly more number of tillers than under flat bed planting in both the years and at all stages of growth. It was also observed that the rate of tillering was more during first month of sowing the crop and that the tillering continued after 90 days also. The numbers of total tiller at maturity were found to be 105.0, 107.2 and 110.2 under CT, RT and FIRB planting at maturity in first year. The values in the second year under the different tillage and crop establishment methods were little less to that of the tillers in first year. The average numbers of effective tillers which bear spikes were found to be less than the total tillers at 90 days after sowing the crop. This indicated that the tillers failed to bear spikes which emerged after or around 90 days and this was true in the wheat crop grown in two years under all the tillage and crop establishment methods. The percentage of total tillers at maturity which failed to bear spikes had been 8.0, 7.4, and 10.0 under CT, RT and FIRB planting systems. The statistical analyses of the data have shown that the tillage and crop establishment methods influenced the average number of effective tillers in wheat crop which were significantly lesser under CT than under RT and FIRB planting system. Yadav et al (2002a) have found that number of effective tillers were more under zero tillage than under CT.

The spikes length averaged 8.2, 8.0 and 8.8 cm in the first year crop and 8.0, 7.9, 8.2 cm for the second year under CT, RT and FIRB planting, respectively. Statistically the difference in spike length under two tillage options were not significant through the spikes were found to be significantly longer under FIRB system than flat bed system. The data on number of grains / spike presented in table 2 have shown that the number varied from 31.3 under reduced tillage to 33.7 under FIRB planting in the first year and 31.1 to 32.7 in second year. Thus the FIRB planting produced more number of grains / spike. However, statistically the differences in this character with respect to tillage options were not found significant, whereas FIRB planting produced significantly more number of grains/spike than under flat bed planting. The test weight (1000 grains) was found to be about 2.0 gm higher for the grains produced under FIRB planting of wheat compared to conventional tillage. This difference was found to be statistically significant for both the years. The tillage options also influenced significantly the test weight, being higher under RT. It was thus evident that FIRB planting and reduced tillage produced grains of heavier weight than under conventional tillage. Yadav et al (2002a) reported that number of grains/spike and test weight had significantly higher values under zero tillage than CT., whereas Yadav et al (2002b) found that these two characters had higher values under FIRB planting than CT. On the contrary, Hossain et al (2003) reported that number of grains/spike and test weight in wheat did not differ significantly under FIRB and flat bed planting systems.

The average grain yield was found to be 43.0, 43.3 and 45.4 q /ha under CT, RT and FIRB planting in the first year with almost similar yield in the second year under these methods (Table 2). It was thus clear that the grain yield under FIRB was higher by about 2.4 q / ha compared to the grain yield under conventional tillage in the first year with almost similar difference in the second year. On subjecting the grain yield data to statistical analysis, it was found that the FIRB planting method of wheat sowing produced significantly higher grain yield than conventional and reduced tillage. This may be attributed to the difference in yield contributing characters viz. spike length, number of grains / spike and test weight which were superior under FIRB planting method of wheat crop. The cumulative / combined effect of all the three yield contributing characters had produced significant differences in grain yield under FIRB and flat bed planting. It was further observed that the grain yield under conventional and reduced tillage were at pa statistically. Singh and Singh (1992),and Malik et a (2000) reported that CT produced grain yield of whe higher or similar to zero tillage whereas, Singh al(2002a) and Malik *et al.* (2004) reported th wheat yield was significantly higher under ZT th under CT. Singh *et al.* (2002b), Yadav *et al.* (2002

Aggarwal and Goswami (2003) observed that bed planting of wheat sowing produced significantly higher grain yield than flat bed planting, whereas Hossain *et al.* (2003) and Jat and Sharma (2005) reported that FIRB method of sowing wheat was not superior than flat bed planting.

The straw yield of wheat crop varied from 71.4 q / ha under reduced tillage to 72.1 q /ha under FIRB planting method in the first year and from 71.3 q / ha under reduced tillage to 72.6 q / ha under FIRB planting technique in the second year. The statistical analyses of the data have shown that the straw yield was significantly higher under FIRB planting than on flat bed planting. The biological yield under FIRB planting exceeded about 3 q / ha compared to flat bed planting (table 2) and it was found that the differences were statistically significant in both the years whereas the effect of tillage practices was not found significant on this character. The harvest index varied from 37.4 % under conventional tillage to 38.6 % under FIRB system of wheat sowing during first year with almost similar values of harvest index under all the methods of tillage and crop establishment. The harvest index was found significantly higher under FIRB planting than under flat bed planting. Hossain et al (2003) have reported that straw yield and harvest index were significantly higher under FIRB method than under flat bed planting whereas tillage options had no effect.

Water Productivity

The water requirement of wheat crop in this experiment was found to 2984 m^3 / ha under conventional tillage followed by under reduced tillage (2423 m^3 / ha). This indicated that the wheat crop requires about 980 m^3 / ha water less under FIRB planting system compared to conventional tillage and

Table 1: Effect of different tillage and crop establishment methods on on growth character of Wheat.(Two years data)

T & CE *Methods	Plant height (cm) at DAS**			
	30	60	90	Harvest
FIRB	7.9	45.3	92.9	92.9
RT	7.1	42.9	89.8	89.8
CT	7.6	44.4	90.9	90.9
CD 5%	0.37	0.48	0.45	0.45
	Total tillers/m^2			
FIRB	75.0	84.3	100.0	109.2
RT	72.1	84.0	98.8	106.3
CT	71.1	81.3	97.5	104.5
CD 5%	0.81	1.11	1.30	1.49
	Effective tillers/m^2			
FIRB	-	-	-	99.0
RT	-	-	-	98.1
CT	-	-	-	96.7
CD 5%	-	-	-	1.04

Table 2: Effect of different tillage and crop establishment methods on yield characters and yield of Wheat (Two years data) .

Tillage & CE methods	Panicle length (cm)	Grains/ spike (no)	Test wt. (gm)	Grain yield (q/ha)	Straw yield (q/ha.)	Biological yield (q/ha)	H.I. (%)
FIRB	8.5	33.2	41.9	45.3	72.3	117.7	38.5
RT	7.9	31.3	40.5	43.2	71.3	114.5	37.6
CT	8.1	32.0	39.7	43.0	71.5	114.5	37.4
CD 5%	0.24	0.95	0.72	0.40	0.46	0.48	0.36

218 m^3 / ha less than reduced tillage. Thus FIRB planting is a water saving technique to the extent up to about 30 % than conventional tillage. In case of wheat crop, the water productivity was estimated as 1.44 kg grain / m^3 water under conventional tillage and 1.78 kg grain under reduced tillage whereas it was 2.05 kg grain under FIRB planting system. Thus raised bed planting had maximum water productivity than flat bed planting. Less water requirement and higher water productivity under FIRB planting have also been reported by Yadav *et al.* (2002b), Aggarwal and Goswami (2003) and Jat and Sharma (2005) for wheat crop.

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DELINEATION OF AGRICULTURAL LAND QUALITY ZONES IN BALLIA DISTRICT USING REMOTE SENSING AND GEOGRAPHICAL INFORMATION TECHNIQUES

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ABSTRACT

The existing research paper devoted to delineation of agricultural land quality zones in Ballia district (25^0 33' N to 26^0 11' N latitude and 83^0 38' E to 84^0 39' E longitude) using modern techniques of geo-informatics such as remote sensing and geographical information system (GIS). Both primary and secondary data have been used in the present investigation. The primary data was collected through remote sensing image, and field visit. The study and mapping of various agricultural land quality zones are identified and categorized as: (i) very good, (ii) good, (iii) moderate, (iv) poor and (v) very poor agricultural land.

Key words : *Agriculture land, using remote sensing*

The quality of agricultural lands is influenced by various physio – cultural and socio – economic factors in a region (Mishra and Chobey, 1999). In Ballia district, physiography, drainage, geomorphic feature, soil, vegetation cover etc. are the controlling factors which govern the nature of agricultural land. The socio – economic and cultural factors on the other hand, generate the circumstances to increase or decrease the land quality. Establishment of settlements and their expansion, extension in canal and road network, garden /groves / tree plantation, chocking of natural drain and resulted problems of water logging and 'usar' formation, creation of infrastructure base etc. may be accounted as the affecting constituents of agricultural land quality. The satellite image is a powerful tool to represent a sum of the total picture of an area. The images are formed by recording the reflectance of various objects of earth's surface at the time of satellite pass. The satellite data in the present investigation has been used to delineate and map out the various zones of agricultural land quality taking into account physical and cultural factors as marked on satellite imagery (Tripathi, 2001; Mishra, 1993; Karel, 1992).

The Ballia district lies between 25^0 33' N to 26^0 11' N latitude and 83^0 38' E to 84^0 39' E longitude (NATMO, 1995). The district is situated in the eastern part of the Uttar Pradesh and bordering Bihar. The district represents a typical triangular shaped 'Doab' of the two great rivers, Ganga and Ghaghara Rivers, the Ganga in the south and the Ghaghara in north. The district covers an area of 2988 km^2. It is characterized mostly by plain land gently sloping (west to east), frequent flood (eastern part) and economically backward district of eastern Uttar Pradesh.

MATERIALS AND METHODS

The mapping of various agricultural land quality zones, investigated through the use of modern techniques of remote sensing. The measurement of the area of various agricultural land quality zones and spatial analysis has been made through GIS techniques. Both primary and secondary data have been used in the present investigation. The primary data was collected through remote sensing image, and field visit. The secondary data collected from topographical sheets (published from Survey of India) at scale 1:250,000 and District planning map (published from NATMO) at scale 1:250,000. Remote sensing technique has been applied for delineation and mapping of agricultural land quality zones. GIS and other computer based techniques are applied in the mapping and analysis of spatial data.

All the maps were prepared by researcher himself using Arc-View GIS–3.1 software. These zones are identified and categorized as: (i) very good, (ii) good, (iii) moderate, (iv) poor and (v) very poor agricultural land quality.

RESULTS AND DISCUSSION

The very good quality of agricultural land is characterized with the intensive cultivation and very good harvesting efficiency. It can be identified and delineated on satellite imagery by very dark tone and smooth texture. The very good quality of agricultural land is registered in Siyar (4.00 %) and Sohawn (15.13 %) blocks. The good quality of agricultural land has been identified by light and fine to moderate texture. It has occupied highest in Rasara (73.20 %) block. The moderate category of agricultural land quality is characterized with mixed tone because of reflectance variation, caused by mixed objects (such as cultivation, settlements, trees, brick industries etc.) and moderate to coarse texture. It has occupied highest area in Reoti (58.54 %) block. The poor quality of land is recorded highest in Chilkahar (23.66 %) block whereas very poor quality of agricultural

Table 1: Agricultural Land Quality Zones in Ballia District (GIS Analysis Based on Remote Sensing Data)
(In Percent)

Block	Very Good	Good	Moderate	Poor	Very Poor	Total
Siyar	4.00	61.33	32.00	2.67	-	100.00
Nagara	-	68.26	13.17	5.39	13.17	100.00
Rasara	-	73.20	9.15	5.23	12.42	100.00
Chilkahar	-	60.22	6.45	23.66	9.68	100.00
Nawanagar	-	64.00	24.00	11.00	1.00	100.00
Pandah	-	65.91	7.95	-	26.14	100.00
Maniyar	-	70.87	12.62	9.71	6.80	100.00
Baruarbari	-	44.00	28.00	8.00	20.00	100.00
Bansdih	-	38.82	20.00	15.23	25.88	100.00
Reoti	-	10.57	58.54	18.70	12.20	100.00
Garawar	-	52.00	21.33	6.67	20.00	100.00
Sohawn	15.13	26.89	31.93	-	26.05	100.00
Hanumanganj	-	10.14	39.13	1.45	49.28	100.00
Dubahar	-	-	39.19	18.92	41.89	100.00
Belahari	-	-	29.27	8.13	62.60	100.00
Bairiya	-	-	27.38	65.48	7.14	100.00
Murlichhapara	-	-	37.96	45.37	16.67	100.00
Total	2.10	4.20	37.19	20.89	35.61	100.00

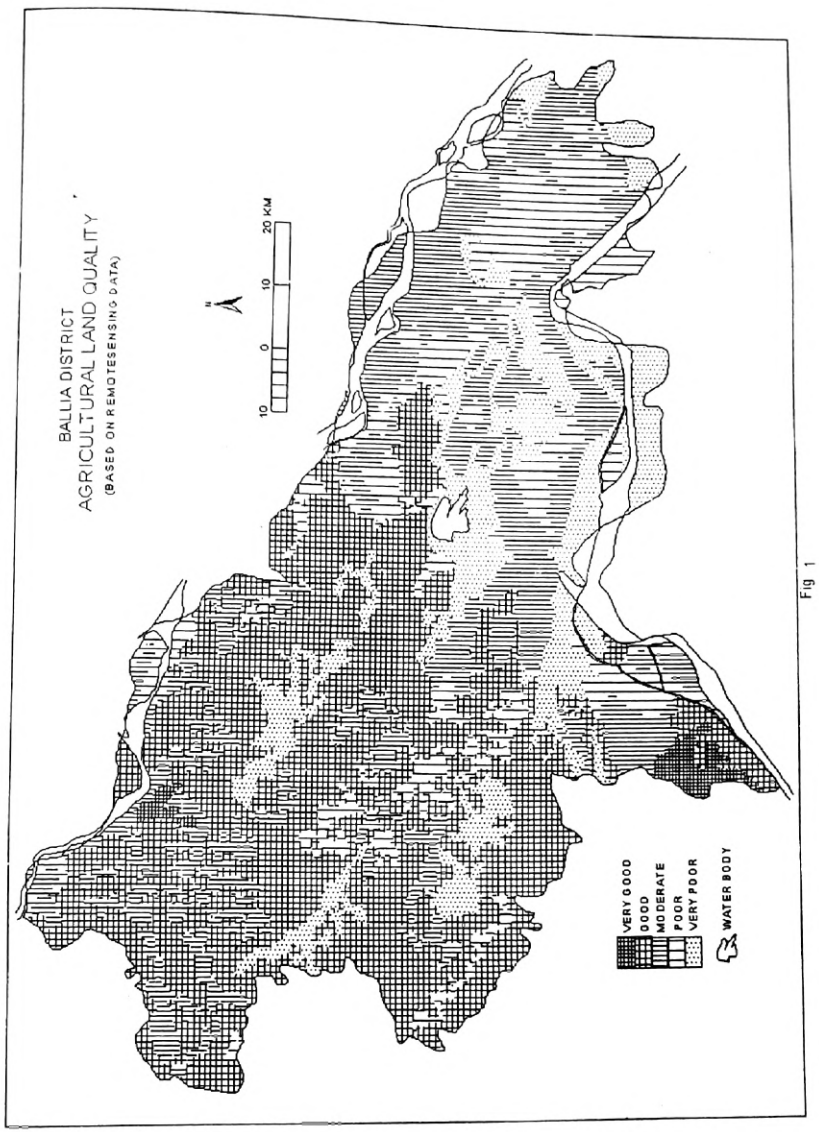

Fig 1

land marked in Belahari (62.60 %) block (Fig. 1 and Table 1).

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MEDICINAL PLANTS, HERBS AND SHRUBS IN THE SERVICE OF LIVESTOCK AND THEIR OWNERS

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ABSTRACT

The present study was conducted among the small and marginal farming, livestock households in five development blocks of Fatehpur district of Uttar Pradesh. The study revealed that 76 percent respondents used indigenous knowledge based medicinal plants to cure there livestock. Plants with medicinal value were found to be the most commonly used ingredients to formulate the treatments. Due to their medicinal power, plants, herbs and shrubs are commonly used throughout the country. The herbal based indigenous knowledge of rural farmers make them the store house for using the same for the betterment of livestock. The major reason cited by the respondents for continuing to use the systems were that people believed in the system and had been using them for a long time.

Key words: *Medicinal plants, livestock, respondents, Fatehpur.*

The science of ayurveda and the use of plants for treating human beings is well known, whereas the sister science of treating poor animals with the plants and herbs is comparatively less known. Ever since animals were domesticated there have been individuals ministering to their health. The indigenous system of treatment with old procedures and concepts is still serving the people (Ghotage, 2004).

Today with the growing concern of the excessive use of contaminants and the resulting residues in the food products of animal origin, it might be the right time to take a look at more organic systems of treating animals including the use of safe plant derivatives for treating the livestock. Medicinal plants have been considered as an important therapeutic aid for alleviating ailments of human as well as livestock. Hundreds, if not thousands of indigenous plants have been used by man from pre-historic times throughout the world for relieving, suffering and curing ailments. It is estimated that India has about forty five thousand plants species and among them several thousands have been claimed to possess medicinal properties.(Annonymous, 2007)

MATERIALS AND METHODS

The present investigation was undertaken in ten villages, two villages each from five development blocks viz., Airayan, Hanswa, Hatgaon, Malwan and Vijaipur of Fatehpur district. From each village twenty livestock owners consisting of ten small and ten marginal farmers were selected randomly thus, a total number of two hundred respondents constituted the sample of study. Multistage stratified random sampling technique was adopted for selection of sample household. The economic strata of respondents was decided on the basis of cultivable landholding as follows:

Marginal Farmers : Having landholding up to 2.5 acre (1.0 ha) along with 1-3 livestock.

Small Farmers : Having landholding from 2.51 to 5.00 acre (1.1 to 2.0 ha) along with more than 4 livestock

Required information were collected from the respondents by using questionnaire developed for the purpose and analyzed accordingly.

RESULTS AND DISCUSSION

In the present study conducted among small and marginal farming-livestock households it was found that more than 76 percent respondents used indigenous knowledge based medicinal plants to cure their livestock. Plants with medicinal value were found to be the most commonly used ingredients to formulate the treatments. The medicinal power of the herbs are due to contents of its active ingredient i.e. flavonoids,. phenols, tannins, steroids, polysaccharides, saponins, glycosides, alkaloids, volatile oils, minerals etc. These components have therapeutic action on body system and different functions. (Prasad and Singh, 2007) The research in fact revealed that medicinal plants, a large number of herbs/shrubs used were found to effectively heal quite a few conditions of digestive tract disorders, control simple ailments, infertility, indigestion, bloat, constipation, diarrhea, mastitis, internal and external parasites, skin condition etc. and to develop immunity against certain virus, bacteria and adverse climatic conditions in livestock production. The findings of the present study are in agreement with the findings of Mishra *et al.*, 2007.

Common Name	Scientific Name	Use
Ajwaine	*King cumin*	In stomach ache, indigestion and cholera.
Aonla	*Emblica officinallis*	Leaf powder for wounds
Aswagandha	*Withania somanifera*	As galactagogue
Bhringraja	*Eclipta alba*	As thermogenic and anti inflammatory
Bamboo leaves	*Bambusa arundinces*	As emmenogogue
Bamboo leaves (buds)	*Bambusa arundinces*	Used for anoestrus
Black paper	*Piper nihrum*	As carminative and anti inflammatory
Cúrry leaves	*Murraya koenigi*	As carminative
Cardamom	*Electtaria cardamomum*	As carminative, alexiteric and diuretic
Custard apple	*Annona squamosa*	Pest repellant
Drumstick	*Moringa oleifera*	Leaf juice in eye infection
Garlic	*Allium sativum*	As anodyne, antibacterial, antifungal, aperient & diuretic
Ginger	*Zingiber officinale*	Regulates digestion and used as anthelmentic, helpful in cough
Madar	*Calatropis procera*	Used for anoetrous, flower and new leaves for stomach pain
Marigold leaves	*Tagetes palula*	As diaphoretic
Neem leaves	*Azadirachta indica*	As purgative antiseptic and antihelmentic
Poppy seeds	*Papaver somniferum*	As tranquilizer
Saunf	*Foeniculum vulgare*	As galactagogue
Shatawar	*Asparagus racemosus*	As galactagoque and for skin diseases
Sugarcane leaves	*Saccharium officinarium*	As metabolizer and expulsion of placenta
Tamarind	*Tamarindas indica*	Regulates digestion
Tulsi leaves	*Ocimum sanctum*	As diaphoretic
Turmeric (Haldi)	*Curcuma longa, C. domestica*	As antiseptic,anti- anflammatory, in skin disease and control of ectoparasites.

Archeological evidences provide substantial clues that prehistoric people were well aware of medicinal properties of plants. They used plants as a whole or their parts as a source of medicine and health tonics both in medicinal as well as veterinary practices since ancient.

Trees, shrubs, herbs, weeds, grasses, climbers and creepers with medicinal quality and their different parts like leaves, roots, stems, barks, flowers, fruits, etc. are respectively used in the treatment of Livestock. Some of the common medicinal plants used by the Livestock farmers of the study area are presented here with their use for treatment.

The herbal based indigenous knowledge of rural farmers make them the store house for using the same for protecting, promoting and treating simple Livestock health related disorders at their door. Thus keeping in view the changing global scenario and bio-security measures the community may be benefited by assessing the rationality of indigenous herbs and medicinal plants knowledge and by merging the scientific reasoning with the modern stream of knowledge. The use of medicinal plants in solving the health ailments is based on long experiences, transmitted from ancestors to descendants and due to their faith in system are still being used by the people as per their need, resource availability and agro-ecological situations.

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ADOPTION OF RECOMMENDED METHODS OF RECLAMATION OF SODIC LANDS

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ABSTRACT

Farmers were adopted the recommended mechanical, biological, chemical and agronomic methods of sodic land reclamation. Recommendations about drainage practices required for sodic lands were also practiced by farmers, significantly.

During investigation the opinion of respondents were taken regarding the suggestions for improvement in the knowledge & skill of farmers regarding reclamation practices. Respondents suggested that training, method demonstration and result demonstration about the sodic land reclamation practices particularly special ploughing for various categories of sodic lands and knowledge about exchangeable sodium percentage and organic carbon in the soil, should be organized regularly.

Key words *: Adoption, sodic land, control*

All the soils contain some amount of salts which, though in small quantities (pH below 8.5) are not harmful for the growing plants but their excessive presence (pH above 8.5) may either inhibit or deter growth resulting in conspicuous reduction in crop yield, the extent depending on the kind and amount of salts present, the plants grown and the environmental factors. Soils which contain excess soluble salts that affect plant growth adversely are called "salt affected soils". These problem soils comprise saline soils that contain sufficient soluble salts to interfere with the plant growth, and 'Alkali Soils' that contain excessive exchangeable sodium to adversely affect the crop production. 'Salt affected soils' is a general term which includes soils having an excess of soluble salts or an excess of exchangeable sodium, or both, to an extent that their presence or action can affect or completely inhibit production of most crops. Salt affected soils are also called 'sodic lands'.

'Sodic lands' are formed when soil and hydrological conditions favour the accumulation of soluble salts in the root zone of crops. Inadequate precipitation and salty irrigation water render the soil salty in the absence of sufficient natural leaching. Sodic lands have high pH (upto 10.8 in 1:2 soil water suspension) and very high exchangeable sodium percentage throughout the profile (as high as 90).

Uttar pradesh has highest area under usar (sodic lands). Considering the potential of sodic lands to produce good quality of crops and need of increasing acreage under cultivation, government of Uttar Pradesh has started U.P. sodic land reclamation programmes in 1989 with the financial assistance of World Bank and European Union. Sodic land reclamation programmes of U.P. are operated by Uttar Pradesh Land Development Corporation (U.P. Bhumi Sudhar Nigam).

MATERIALS AND METHODS

Four villages of block kakwan and four of block maitha were selected from District Kanpur Dehat. Likewise four villages of block Hasanganj and four of block Nawabganj were taken in the study. From the list of beneficiaries having land under sodic land reclamation programmes, 50 respondents were selected from each block through random sampling technique. Thus, a total of 200 respondents were selected from four blocks of two districts for the study.

Information regarding the present investigation were collected after personally interviewing the respondents of the total sample. Data were collected by personal interview method. The statistical measures used in the study were percentage and x^2-test.

RESULTS AND DISCUSSION

I-Mechanical Methods of Reclamation of Sodic Lands :

Data were collected about adoption of various recommended mechanical measures of management of sodic lands. The findings are given in table- 1.

Table 1 pastulates that leaching is highly adopted mechanical practice contributing 62.5 per cent respondents as fully aware followed by the adoption of practices namely levelling, flush washing and scrapping with 60 per cent, 52.5 per cent and 30 per cent respondents as fully aware, respectively.

The finding clears that the efforts of sodic land reclmation agencies in popularizing the mechanical methods of sodic land reclamation programmes are very successful in farming community.

X^2 values reveal that most of the mechanical methods of Sodic land reclamation were being significantly adopted by the beneficiaries whereas, it was negative in case of weekly flush washing. Similar observation made by Khosal and Gupta (1983), Kumbhare and Prasad (1986).

II- Biological Methods of Reclamation of Sodic Lands :

An analysis was made about the level of adoption of various biological practices recommended at scientists' level for effective management of sodic lands. The results are given in table 2. It is clear from the table-2 that green manuring with Dhaincha was the most popular practice with 90 per cent adoption among the farmers followed by the adoption of farm yard manure (65 per cent), residue of paddy crop (52.5 per cent), residue of wheat crop (15 per cent), Green Manuring with legumes and application of press mud (10 per cent), legumes (5 per cent) and use of wormicompost (1.5 per cent), respectively.

The finding portrays that the biological methods of sodic land reclamation are becoming popular. But there is need to intensify the efforts to increase the level of adoption of application of press mud, residue of crops of wheat & legumes and vermicompost.

The values of x^2 give indications that the recommendations about biological methods of sodic lands are significantly adopted by the beneficiaries. Significant values were also found as a result of high rate of non adoption of Green manuring with other legumes, application of press mud and application of wormicompost.

III-Timely application of appropriate quantity of gypsum :

Gypsum is the basic chemical that is needed for reclamation of sodic lands. Timely application of suitable quantity of gypsum is very necessary in reclaiming the sodic lands effectively and permanently. An observation was made about the level of adoption of use of Gypsum. The results are given in the following table.

It is evident from the above table that there was full adoption of timely and appropriate quantity of gypsum in case of 'C' class sodic lands, whereas, 85 per cent respondents were fully adopted the timely and suitable quantity of gypsum for 'B' class lands. Only 74.3 per cent farmers were adopted the timely application of appropriate quantity of Gypsum in 'A' class sodic lands.

It is observed that there is excellent adoption of suitable quantity and timely application of gypsum in sodic lands. It was also realised that farmers should come forth to bear the expenditure of gypsum and its application for 'A' class sodic lands.

Values of x^2 indicates that the scheme had significantly influenced the adoption of timely application of appropriate quantity of gypsum. Similar observation made by Singh *et al.* (1980)

Table- 1 : Mechanical methods of reclamation of sodic lands

N=200

S.No.	Recommended Methods	Level of adoption		Value of x^2
		Adopted	Not-Adopted	
(a)	Scrapping	60(30)	140(70)	32.0***
(b)	Levelling (according to the requirement of field)	120(60)	80(40)	80***
(c)	Leaching (10-15 cm deep water for 10-15 days)	125(62.5)	75(37.5)	4.50*
(d)	Flush washing (weekly)	105(52.5)	95(47.5)	0.50^{NS}

* Significant at 5.0 per cent level of significance
*** Significant at 0.1 per cent level of significance
NS Non-significant
Figures in parenthesis are percentage

Table-2 Biological Methods of Reclamation of Sodic Lands :

N=200

S.No.	Recommended methods	Level of adoption		Value of X^2
		Adopted	Not-Adopted	
(a)	Green manuring			
	(i) Dhaincha	180 (90)	20 (10)	128***
	(ii) Other legumes	20 (10)	180 (90)	128***
(b)	Farm-yard manure	130 (65)	70 (35)	18***
(c)	Press mud	20 (10)	180 (90)	128***
(d)	Residue of crops			
	(i) Paddy	125 (62.5)	75 (37.5)	12.5***
	(ii) Legumes	10 (5.0)	190 (95)	162***
	(iii) Wheat	30 (15)	170 (85)	98***
(e)	Vermi compost	3 (1.5)	197 (98.5)	188***

*** Significant at 0.1 per cent level of probability
Figures in parenthesis are percentage.

Table- 3 : Timely application of appropriate quantity of Gypsum

SNo.	Category of sodic land	Recommended dose	Level of adoption		Value of x^2
			Adopted	Not-Adopted	
(a)	'A'	6 Tonnes/ha	52 (74.3)	18 (25.7)	16.5*** (69 DF)
(b)	'B'	10 Tonnes/ha	80 (85)	14 (15)	46.34*** (93 DF)
(c)	'C'	13 Tonnes/ha	60 (100)	0 (0)	60.0*** (59 DF)

*** Significant at 0.1 per cent level of probability
Figures in parenthesis are percentage

Table- 4 : Agronomic practices for reclamation of sodic lands

S.No.	Practices	Level of adoption			Value of x^2
		Fully Adopted	Partially Adopted	Not-Adopted	
(a)	use of appropriate quantity of recommended chemical fertilizers	125 (62.5)	45 (22.5)	**30 (15)**	78.25***
(b)	Special ploughing for different categories of land	25 (12.5)	95 (47.5)	80 (40)	40.75***
(C)	Use of good quality of irrigation water	30 (15)	30 (15)	140 (70)	161.74***

*** Significant at 0.1 per cent level of probability
Figures in parenthesis are percentage

Table- 5 : Adoption of recommended drainage practices

N=200

S.No.	Recommended Practice	Level of adoption		Value of x^2
		Adopted	Not-Adopted	
I.	Proper slope of land	185 (92.5)	15 (7.5)	144.5***
II.	Link drain and field drain	190 (95.0)	10 (5.0)	162***

*** Significant at 0.1 per cent level of significance
Figures in parenthesis are percentage

IV-Agronomic practices for reclamation of sodic lands :

Data were collected about adoption of different agronomic practices recommended for effective management of sodic lands. The findings are summarized in table- 4.

Table- 4 pastulates that the maximum adoption (62.5 per cent) was found in case of recommendations about application of appropriate quantity of gypsum followed by full adoption in case of use of good quality of irrigation water (15 per cent). The findings also indicated that a majority of target beneficiaries were not adopting the recommended special ploughing in different categories of sodic lands.

Thus, it was found that sodic land reclamation programmes are significantly influencing the level of adoption of various recommended agronomic parctices in sodic land. It was also perceived that the efforts should be made to increase the level of adoption about special ploughing and use of good quality of irrigation water.

Values of x^2 indicate that the recommendations about agronomic practices of sodic land reclamation have been significantly adopted by the target beneficiaries.

V-Adoption of recommended drainage practices:

Drainage is the essence of sodic land reclamation programmes. Effective drainage system is strictly needed for effective implementation of any reclamation and management programme of sodic lands. The data collected about the level of adoption of recommended drainage practices are presented in the table- 5.

The above table reveals that there is excellent adoption of construction of field drain and link drain with 95 per cent level of adoption as well as in case of proper slope of land with 92.5 per cent level of adoption among respondents.

Therefore, it has been concluded that the drainage practices started during the sodic land reclamation programmes are continued by the farmers.

Values of x^2 pastulates that there is significant adoption of recommended drainage practices.

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CONTROL EMISSION OF SO_2 AT THERMAL POWER PLANT RAJASTHAN: A STUDY ON pH OF NaOH SOLUTION AND FLOW OF FLUE GASES IN IMPINGERS CONTAINED NaOH.

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ABSTRACT

SO_2 is a major constituent in air pollution. Sulphur dioxide produced during combustion of fuels containing Sulphur, and effects the environment in number of ways like acid rain, corrosion and severe damages to the health. Hence our aim of the project is synthesis of some commercial applicable compound by using a waste stream of SO_2 contained in flue gases. In accordance with the invention two parameters regards to pH of NaOH solution and flow of flue gases in impingers were studied for recovery and maximum utilization of SO_2. Thus it is concluded that pH of the solution should be alkaline for good absorption of SO_2 and maximum absorption of SO_2 found in direct passing of SO_2 in impinger as compared to indirect passing of SO_2 in impingers. The present work was done by passing of flue gases containing sulphur dioxide in a solution which was rich with Sodium ions using SO_2 monitoring kit of SO_2 measurement, then SO_2 reacts with these ions to produce Sodium sulphate. All most complete removal of SO_2 in flue gases has been observed using this Process in thermal power plant.

Keywords: *Flue gas desulphurization, flue gases, pH, thermal power plant.*

The demand of electricity is continuous increasing and it is expected to double in 7 -10 years and the pollution in the environment likely to increase in the coming years. The main pollutants from the thermal power plants are dust and objectible gases like CO, CO_2, SO_2, NO_2 etc. SO_2 is a major constituent in air pollution. Petcoke having 6 % Sulphur are being used for Power generation in thermal Power plant. A typical 6 MW power generation unit using furnace oil containing 2 % Sulphur, will emit 388 tons of SO_2 per year based upon 320 working days .[4] A 22.5 MW power generation unit will emit 1690 tons of SO_2 per year. Flue gas desulphurization (FGD) is the technique used for removal of sulphur dioxide from the exhaust flue gases in Power plants. Therefore our aim of the project is to reduce the percent SO_2 in environment and to produce a byproduct with SO_2 So that SO_2 emission can be controlled.

MATERIALS AND METHODS

Experimental – A

Effect of pH of solution for SO_2 absorption.

All the chemicals used were of AR grade. All experiments were conducted on Stack monitoring Kit (Model No. and Make -VSS1, 141 DTH -2005, Vayubodhan) First of all SO_2 monitoring kit of SO_2 measurement was set up at chimney inlet. 10 % sodium hydroxide solution was prepared by dissolving of 10 g NaOH in 100 ml of DM water. Then this solution was taken in first impinger and flue gases containing SO_2 was provided in first impinger using a flexible pipe connected to the SO_2 monitoring kit. The flow of SO_2 was controlled using an inlet line rotameter and was maintained at a value of 3 liter/min. One end of flexible pipe was connected to chimney inlet for suction of SO_2 and other end of flexible pipe was connected to SO_2 monitoring kit which having impingers of 10 cm diameter and 100 cm length. The impinger was filled with 100 ml of scrubbing media i.e. NaOH solution. Samples of 10 ml was collected from the bottom at intervals of every 15 minutes and each sample was

analyzed for pH. and also titrating it with 1 M oxalic acid to determine falls in concentration of NaOH. (Methods obtained for this work from Indian Standard method book IS 1125, IS582, IS1514, IS1560, IS250 and IS3025)

Experimental – B

Effect of flow of flue gases in impingers containing NaOH for maximum absorption of SO_2

Direct passing of Flue gases in impingers :

Control flow of hot flue gases through rota meter at the rate of 3 liter/Min passed in 100 ml of 10 % NaOH solution for half an hr. without separation of dust. pH of the solution around 12.57 and temperature around 25 – 30 °C.

By Filtering the flue gases through monitoring Kit:

Control flow of hot flue gases after separation of dust in first impinger containing water (20 ml), at the rate of 3 liter/Min passed in 100 ml of solution (50 – 50 ml in two impinger) for half an hr. A 10 % NaOH solution was taken for experiment. pH of the solution was around 12.57 and temperature around 25 – 30 °C . Experimental Set up shown in figure -7 and Operating conditions for SO_2 absorption are given in Table -1.

RESULTS AND DISCUSSION

Figure -1 and table – 1 reports that effect of pH of NaOH solution and absorption of SO_2 and it is confirmed that when increase in the time period for absorption of SO_2 in NaOH solution, then there is a significant decrease in pH. Figure -1 reports that with the increase of time period for absorption of SO_2 in NaOH solution there is a significant decrease in conc. of NaOH Solution.

Figure -3 and table – 2 reports that maximum recovery of SO_2 is obtained when flue gases passes in the NaOH solution directly instead of indirect passing. Figure-4, figure -5 and table -3 reports that maximum % of SO_3 (Gravimetric) and maximum % SO_2 (Volumetric) was found in that precipitate which was prepared by directly passing of flue gases in NaOH solution rather than the one prepared by indirect passing of flue gases. Figure -6 reports that Analysis of by-product confirmed that decreasing the % of SO_3, significantly increases % alkalinity. Because of they are inversely proportional to each other. Similar findings made by Buecker (1986, 2006), Dene (2007), Stack ans Hollindon (1975), Seth and Patel (2006), Gosawi (2005), Maohong and Brown (2002), Sung and Brown (2002), Huang and Ong (2002).

1. SO_2 absorption has been taken place in the solution.
2. The change in colour of the solution can be seen easily i.e. initial colour is white, and after passing SO_2 colour is yellow.
3. The pH should be more alkaline for good absorption of SO_2.
4. Maximum recovery of SO_2 observed in passing of SO_2 in direct medium due to following reason:

   When flue gases passes in water (for separation of dust particles) it reacts with it and form sulfurous acid and conc. of SO_2 falls. This is the reason for high % of SO_3 and % SO_2 found in direct passing of flue gases in sodium hydroxide solution is high as compared to indirect passing. and this effect can be seen by checking pH at the beginning and at the end of the experiment. i.e. (In starting of Experiment pH was 12.57 and after passing of SO_2 pH changed up to 1.75)

   $H_2O + SO_2 \rightarrow H_2SO_3$ Sulphurous acid

   $H_2O + SO_3 \rightarrow H_2SO_4$ Sulphuric acid
5. Prepared Na_2SO_4 can be used as a home laundry detergent, and also used in paper production. In the laboratory Na_2SO_4 is used as an inert drying agent, for removing traces of water from organic solutions.

Table 1: Operating conditions for SO_2 absorption in Sodium hydroxide solution

S. No	Operating Condition	Value
1	Initial Concentration of Sodium hydroxide solution	10 %
2	pH of solution	12.57
3	Total liquid hold up	100 ml
4	Temperature of solution	25-30 °C
5	Time period for reaction	0.5 hr
6	Flow of flue gas in impinger	3 LPM
7	SO_2 load in flue gas	3000 – 3200 ppm
8	Flue gas Temperature	135 °C
9	Flue gas flow in duct of ESP O/L	150522 m^3/hr
10	Pet Coke Feeding Rate	13 ton/ hr
11	Lime Stone Feeding Rate	1.0 ton/hr

Table 2 : Effect of pH of NaOH solution for absorption of SO_2

S. No.	Time(Min.)	pH of solution	Volume of 1 M Oxalic acid consumed in titration using phenolphthalein indicator (ml)	Conc. of NaOH (%)
1	0	12.57	20.05	80.06
2	15	10.62	15.56	62.2
3	30	8.82	3.5	14.2
4	45	7.95	1.23	4.8
5	60	5.62	0.56	2.2
6	75	4.75	0.32	1.2

Table 3: Effect of direct and indirect flow of flue gases in NaOH solution and removal efficiency of SO_2

S. No.	Flow of SO_2 gas	Initial Concentration of SO_2 (ppm)	Concentration of SO_2 after formation of Sodium sulphate (ppm)	Recovery(%)
1	Direct	3050	145	95.25
2	Indirect	3050	1818	59.62

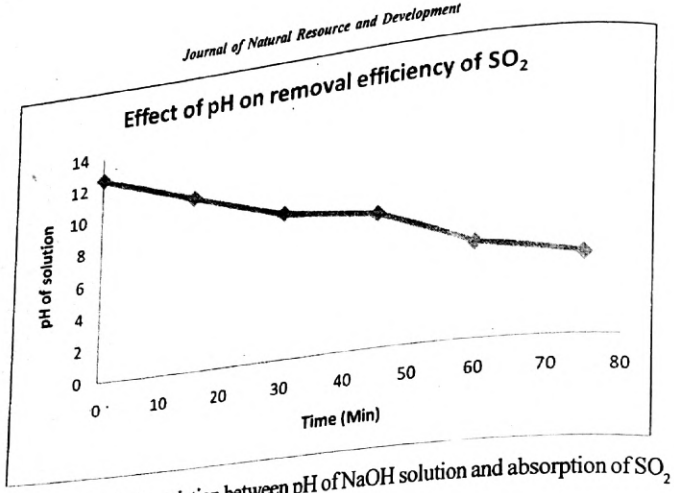

Fig. 1: Figure depicting relation between pH of NaOH solution and absorption of SO_2

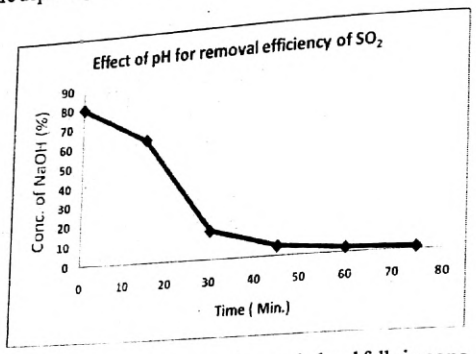

Fig 2: Figure depicting relation between time period and falls in conc. of NaOH.

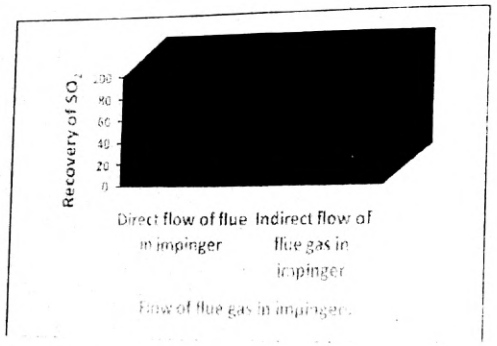

Fig 3: Effect of direct and indirect flow of flue gases in NaOH solution with % recovery of SO_2

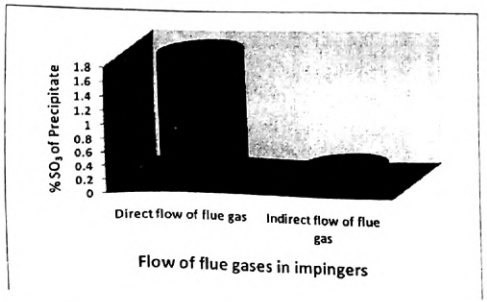

Fig 4: Effect of direct and indirect flow of flue gases in NaOH solution and % SO_3 of precipitate.

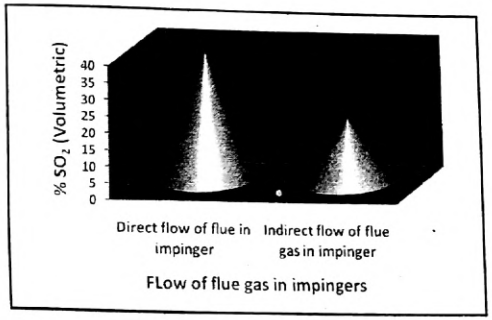

Fig 5 : Effect of direct and indirect flow of flue gases in NaOH solution with % SO_2 (Volumetric)

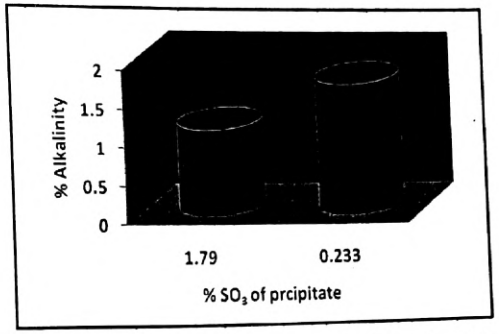

Fig 6 : Relation between % SO_3 and % alkalinity of precipitate.

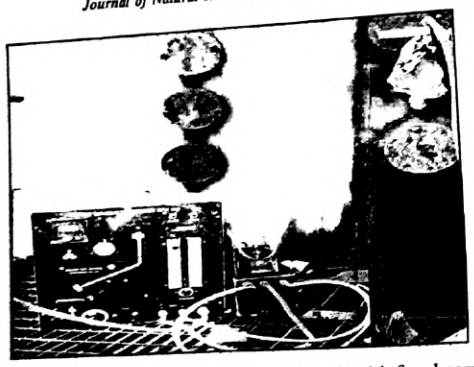

Fig. 7 : Experimental Set Up by using SO_2 monitoring kit for absorption of SO_2

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SURVEY REPORT ON ROOT KNOT NEMATODE INFECTION IN GREEN ONION IN ALLAHABAD DISTRICT.

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ABSTRACT

Among the bulb crops onion is the most important vegetable crop grown in Allahabad. Onion cultivated areas in Allahabad were surveyed for assessing the incidence and intensity of root knot disease in Green onion. The incidence ranged from 53.6 to 88.8% and the intensity (RKI) varied from 2.1 to 3.9. Relatively more number of fields was recorded under medium to heavy infection categories.

***Key words**: Onion, Meloidogyne incognita, incidence, intensity.*

The onion (*Allium cepa* L.) is grown from ancient times in India. It is grown in an area of 2.6 lakh ha. Producing 27 lakh tones of bulbs for local consumption as well as for export purpose. Of the fifteen vegetable crop listed by FAO **(Annon. 1973),** Onion falls second only to tomato in terms of annual world production. Onion is an important indispensable item in every kitchen as condiment and vegetable, hence commands an extensive internal market.

Among the various pests and diseases associated with onion, the root knot nematode (*Meloidogyne incognita*) had proved itself as an important limiting factor for successful cultivation of this crop. **Richard et,al. (2003)** reported that the root knot nematodes *M.incognita , M.javanica & M.arenaria* are widely distributed throughout the world and are present in some of the major onion producing states in U.S. The three root knot species were all capable of significant reproduction on onion , though soil temperatures during the onion growing season in Georgia probably limit reproduction to one or two generations . Regardless of nematode damage, direct-seeded onions in Georgia have a lower economic return than transplanted onions even though production costs are significantly lower. **Widmer et. al. (1999)** reported the increasing occurrence and damage of root knot nematode to onions, carrot & lettuce grown on organic soils in New York. Root knot nematode has been observed to cause serious losses to onion crop in Northern Old Alluvial Zone of West Bengal **(Chakraborti 2002).** A systematic survey on green onion cultivation in Allahabad region was conducted. It has been observed that root knot nematode cause serious losses to onion crop grown mostly in the field located near the Jamuna & Ganga river belt.

MATERIALS AND METHODS

Survey of root knot disease (*M. incognita*) in green onion was conducted in 12 villages viz. Dandi ,Naipora , Lavayan , Sangpora , Samara , Murlikot , Dhadri , A.A.I. (D.U.) research plot , Chhoeki , Kharkona , Snaipora and Kanti .Five field were selected in each village for observation of root knot incidence . 25 onion root samples were uprooted randomly from each plot (10 sq. m area) and collected in the polythene bags. Root samples were thoroughly washed under tap water and were examined by using hand lens and stereoscopic binocular for the presence of root knot /10 gm root sample caused by *M. incognita*. For recording average root knot disease incidence (%) , number of knots on roots and intensity of gall development on roots was measured by a root knot index on visual observation of the root system on 1-5 scale **(Hussani et.al 2002)** as given below :

Table 1 : Root knot index

Categories (root knot index)	Remarks
0 to 1.0	Healthy
1.1 to 1.9	light
2.0 to 2.9	Medium
3.0 to 3.9	Heavy
4.0 to 5.0	Very heavy

The infested roots were stained with cotton blue lactophenol to see the different stages of *Meloidogyne spp.* Infested root were cut in to small pieces, grinded and passed through 300 mesh sieve and examined and counted the number of larvae / 10 gm root sample.

RESULTS AND DISCUSSION

This is the first report of root knot nematode disease in green onion in Allahabad region. This disease was found to be wide spread in all onion growing area of Allahabad with an average incidence as 82.04% .The range of incidence varied from 53.6 to 88.8% among all twelve villages. The disease intensity on plants is expressed as root knot index (RKI) on 1-5 scale **(Hussani et.al 2002)**. The average RKI on the crop was 2.8 and it varied from 2.1 to 3.9 .The disease index was maximum (3.9) in Kharkona followed by Dhadri (3.7) , Chhoeki (3.5) , Murlikot (3.4) , Kanti (2.7) , Lavayan and Snaipora (2.6) , Naipora (2.5) , A.A.I.(D.U.) research plot (2.4) , Sangpora and Samara (2.2) , and Dandi (2.1) .The increasing occurence and damage of this nematode to onion need standard and efficient control measure to be adapted in order to save the crop from huge loss . **Richard et. al. (2003)** reported that Onion is good host for all *Meloidogyne* species (*M.incognita, M.javanica & M.arenaria*) tested and *M.incognita* can reduce yields and economic return when onions are direct seeded. Transplanted onions did not suffer economic loss.

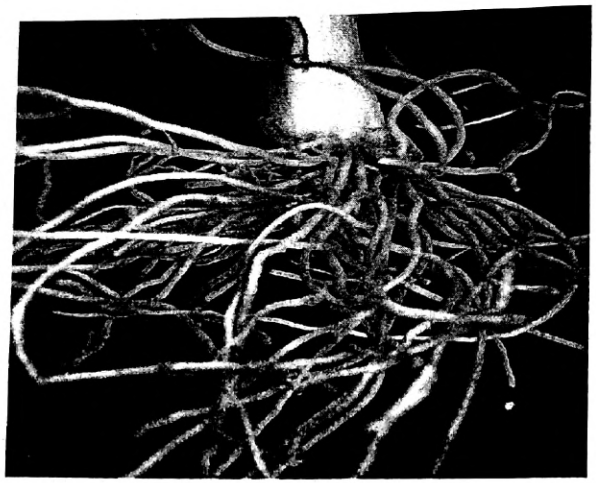

Fig. Root Knots in green Onion

Table 2: Status of root knot disease incidence in Allahabad region

Sl.No.	Name of village	No,. of infested plants / field (25 plants uprooted/10sq. m area in each fields)					Av. Root knot disease incidence (%)
		F1	F1	F1	F1	F1	
1.	Dandi	16	14	14	13	10	53.6
2.	Naipora	21	17	17	16	18	71.2
3.	Lavayan	13	19	16	14	20	65.6
4.	Sangpora	20	14	18	—	23	60.0
5.	Samara	—	11	19	18	21	55.2
6.	Murlikot	17	14	21	19	20	72.8
7.	Dhadri	12	19	15	17	17	64.0
8.	A.A.I.(D.U.) R.P.	21	19	16	19	12	69.6
9.	Chhoeki	13	22	18	20	17	72.0
10.	Kharkona	23	22	19	23	24	88.8
11.	Snaipora	19	21	16	19	—	60.0
12.	Kanti	—	14	18	18	19	71.2
	Total	175	206	207	196	201	985
	Mean	14.58	17.16	17.25	16.3	16.75	82.04

Table 3 : Status of root knot population, no. of larvae and root knot index in Allahab district.

Sl.No.	Name of villages.	Av. No of root knot population / 10 gm. root.	Av. No of larvae /gm. root	Root knot index.
1.	Dandi	21.2	40.2	2.1
2.	Naipora	25.2	54.0	2.5
3.	Lavayan	26.6	70.2	2.6
4.	Sangpora	22.4	48.0	2.2
5.	Samara	22.4	63.8	2.2
6.	Murlikot	34.2	84.8	3.4
7.	Dhadri	37.0	98.4	3.7
8.	A.A.I.(D.U.) R.P.	24.4	68.6	2.4
9.	Chhoeki	35.2	92.2	3.5
10.	Kharkona	39.8	102.2	3.9
11.	Snaipora	26.6	69.4	2.6
12.	Kanti	27.2	75.2	2.7

Average (mean) Root knot index is **2.8**

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ISOLATION OF AN ANTHRAQUINONE FROM THE HEARTWOOD OF CASSIA JAVANICA

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ABSTRACT

Cassia javanica is commonly known as pink shower tree . It is laxative and is used as a cure for rheumatism. 1,8-Dihydroxy-3-methyl anthraquinone is isolated from the heartwood of the above plant. Structure identification of the anthraquinone is done on the basis of chemical evidences and spectroscopic methods such as UV , IR , ^{1}HNMR and mass spectroscopy.

Keywords- Cassia Javanica , anthraquinone , isolation , heartwood and chloroform extract.

Cassia Javanica belongs to the family "Leguminosae" and sub family "caesalpiniaceae". It grows throughout India , Java , Sumatra & Malaya. It is a medium sized tree with horizontally spreading branches, 15-30 cm long leaves, dull reddish leaflets and lively pink or rose coloured petals. This plant have great potential uses, such as traditional medicine and pharmacopeial drugs (Oladunmoye et al., 2009) .The root bark, seeds and leaves are used as laxative. The fruits are cathartic and are applied in rheumatism and snake bite. The seeds are emetic and juice of leaves are used in skin diseases (Chopra et al.,1958).

Anthraquinones are anthracene derivatives and these are simply polyhydroxy or methoxy derivatives with or without carbon side chain. Anthraquinone such as emodin, emodic acid, citreoresein show antiplasmodial(Obodozie et al.,2004), antimicrobial(Ayo and Amupitan,2004), insecticidal and mosquito larvicidal activities(Georges et al.,2008).

MATERIALS AND METHODS

The heart wood of Cassia javanica was collected from Allahabad, U.P. The identification was done with the help of Botanical Survey of India, Allahabad. Silica gel for chromatography and AR grade solvents were purchased from Merck.

Extraction:

The air dried and finely crushed heartwood of cassia javanica (5kg) was exhaustively extracted with ethanol (4x2.5l) (methylated spirit) under reflux. The ethanolic extract was concentrated (250ml) under reduced pressure in a rotary evaporator and poured into ice cold water (1.5l) with constant stirring where by the dark brown water insoluble portion (Fraction-I) and brown water soluble portion (Fraction-II) were separated.

Fraction I was extracted successively with hexane , benzene , chloroform and ethylacetate in a soxhlet extractor. The chloroform extract was concentrated and purified with flash column chromatography. The solvents used for elution were hexane , benzene , chloroform , ethylacetate , methanol and their mixtures in different ratio in increasing order of their polarity.

The anthraquinone was isolated using solvent system Hexane:Benzene (1:1 v/v).

Elemental analysis:

Found	Calculated for $C_{15}H_{10}O_4$
C : 70.89%	C : 70.80%
H : 3.77%	H : 3.93%
m.p. : 194°C	

Spectral data:

UV λ_{max}^{EtOH} : 230 , 252 , 274 , 302 , 485 , 520 nm.

IR ν_{max}^{KBr} : 3440 , 2929 , 1672 , 1625 , 1458 , 1342 , 1202 and 754 cm^{-1} .

^{1}H NMR [$CDCl_3$; 100 MHz]: δ 2.15 (3H , S), 7.1 (1H, d, J=2.5 cps, H-2), 7.3 (1H , d , J=2.5 cps , H-

4), 7.8 (3H, m, H-5, H-6, H-7), 12.0 (1H, S), 12.1 (S, 1H)

MS [70 eV, direct inlet] : m/z 254 M^+, 226, 198, 106, 92.

RESULTS AND DISCUSSION

The isolated anthraquinone is yellow in colour, m.p. 194°C. It gives colour reaction characteristics of hydroxy anthraquinone(Robinson,1963).

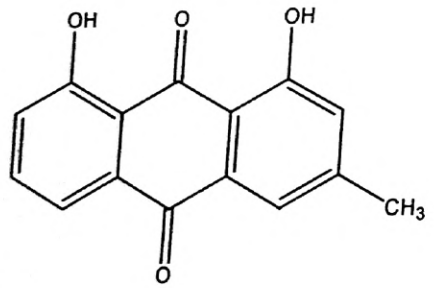
UV and visible spectra of the compound showed λ_{max} 230, 252, 274, 302, 485, 520 nm was in good agreement with its anthraquinonoidal nature. IR peaks at 2920 and 1458 cm^{-1} showed the presence of C-Me group (Brandt and Egliton,1955), a singlet at δ 1.15 in ^1H NMR spectrum confirmed the presence of methyl group at β-position (Thomson,1971). Peak at 3440 cm^{-1} in IR spectrum showed the presence of phenolic hydroxyl group/groups.

The compound formed a diacetate, m.p. 210°C showed the presence of two hydroxyl functional groups in the molecule. The ethanolic extract of the solution of compound gave specific colour reactions for 1, 8 Dihydroxy system in anthraquinone (Feigl and Anger,1966; Lemli *et al.*,1964).

1, 8 -Dihydroxy system was further supported by the peaks at 1672 cm^{-1} and 1625 cm^{-1} of non-chelated and doubly chelated carbonyl groups respectively in the IR spectrum. In ^1H NMR spectrum compound gave five aromatic protons at δ7.1 (d, 1H, J=2.5 cps, H-2), δ7.3 (d, 1H, j=2.5 cps, H-4), δ7.8 (m, 3H, H-5, H-6, H-7) and two hydroxyl groups at δ12.0 (1H, S), δ12.1 (1H, S).

The structure of the compound was further supported by its mass spectrum. The mass spectral data showed the molecular ion peak [M^+] at m/z 254. Strong peaks at m/z 226 [M-CO] and m/z 198 [M-2CO], due to successive elimination of carbon monoxide indicated the anthraquinonoidal nature of compound(Beynon *et al.*,1959). Mass fragmentation pattern showed peaks at m/z 92 and m/z 106. This confirmed that one ring has one hydroxyl group and the other ring has one methyl and one hydroxyl group, respectively.

Thus the structure of compound assigned as 1,8-Dihydroxy-3-methyl anthraquinone (chrysophanol).



1 , 8 -dihydroxy-3-methyl anthraquinone (chrysophanol)

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