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Influence of agro-waste amendment on soil microbial population in relation to plant growth response

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Abstract: *Introductions of high yielding inorganic fertilizer are not cheap and leave behind a large amount of dry matter for disposal. Thus there is a need to utilize these plant residues to save fertilizers and maintain a satisfactory level of soil fertility. Hence, with the view of in-situ manuring as well as to recycle the agricultural residue, pot experiments were conducted to study the effect of wheat husk amendments on soil microbial population and seedling vigour index (SVI) of wheat. Results of pot experiment showed the improvement in soil fungal population followed by bacterial and actinomycetal counts. Statistical significant increase in plant growth was also recorded as compared to unamended control, which indicates the practical possibility in utilizing wheat husk for improvement is soil fertility.*

Key words: *Wheat husk amendment, Soil microbial population*
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Introduction

The microbial flora in soil is an important constituent since soil fertility, plant growth performance and ultimately agriculture productivity depends on it (Ayanaba, 1976; Parthasarthi, 2006). However, the microbial biomass and their activities in soil may fluctuates due to different soil management practises (Doran , 1980; Handrix *et al.*, 1986).

Amendment of soil by FYM (Field yard manure), sheep dung, green manuar, rice straw, and sewage sludge. Sh0owed significant increase in available phosphorus content, microbial biomass and dehydrogenase activity in soil (Sindhu and Beri, 1986; Ghany *et al.,* 1997; Tillak *et al.,* 1986; Mukharjee *et al.,* 1990; Harden *et al.,* 1993 and Saha *et al.,* 1995). Miller (1973), Kulkarni and Pushpa (1993), reported the adverse effect on soil microbial population and activities in sludge and weed amended soils respectively. The review indicates the pausity of information on the agrowaste amendments contribution to soil microbial population with reference plant growth performance (Parthasarthi, 2006).

Hence, with relevance to *in-situ* farming the present work on wheat-husk amendment of soil on microbial population and its effect on plant growth performance was undertaken.

Materials and Methods

Pot culture experiments with vertisol soils were carried out in Randomized Block Design with 3 replications. Wheat husk from local farmer was grinned to fine powder of particle size 2 mm and incorporated manually by proper mix to each pot at graded levels *viz.*1% to 10% w/w. All the pots were irrigated manually and 10 seeds per pot of HD-2189 NSC (*Triticum aestivum* L.) were dibbled prior to irrigation. Pots without wheat husk were maintained as control. From each treatment approximately 1 gm of soil sample was escavated after the interval of 10 days upto 30 days. Bacterial, fungal and actinomycetal counts were analyzed using standard plate technique, (Aneja, 1983). After 15th day of sowing, germination count, root and shoot length was measured and SVI was calculated and analyzed at 5% level of significance (Mungikar, 1992).

Results and Discussion

The result on the present study revealed that wheat husk amendment in vertisol, significantly improves the microbial population over control. It was observed from (Table1) that bacterial count was maximum (44x 10^7/g) at 3 percent level of wheat husk amendment, after 30th day of incubation period and was found to be statistically superior among all the treatments. Above 3% level of wheal husk the bacterial population decrease. The reduction in bacterial population in soil amended with wheat husk above 3% w/w may be due to the generation of aromatic acids as the inhibitory end products during the degradation process. Tein and Kirk (1983), reported the generation of phenol, aromatic acids and alcohol during the depolymerization of ligninocellulosic waste in soil. Secondly the decrease in bacterial population may be a result of generation of microarophilic condition due to evolution of CO_2. It has been reported that the decay of the major plant constituent are found to be depressed as the supply of O_2 diminishes (Alexander, 1983).

In case of fungal population (Table 2) the maximum count (49 x10^5 /g) was recorded at 2% level of wheat husk amendment after 20th day and proved to be statistically significant over control. It was observed that the fungal count decrease along with the increase in concentration of wheat husk above 2% w/w. It has been reported that most of the soil fungi are Zymogenons and grows

Table - 1: Effect of graded levels of wheat husk amendment on bacterial count in vertisol

Treatment Wheat husk w/w(%)	CFU (10^7 /g) of soil Incubation period (days)			
	Initial	10	20	30
Control	26	23	28	31
1	28	30	36	33
2	24	28	31	30
3	38	40	39	44
4	31	33	39	37
5	36	36	35	34
6	34	33	30	40
7	31	29	28	38
8	26	26	26	34
9	24	28	28	27
10	23	25	29	30
F Test	Significant	Significant	Significant	Significant
SE(M) ±	2.97	1.95	2.56	1.85
C.D. at 5% level	8.77	5.75	7.55	5.45

Table - 2: Effect of graded levels of wheat husk amendment on fungal count in vertisol

Treatment Wheat husk w/w(%)	CFU (10^7 /g) of soil Incubation period (days)			
	Initial	10	20	30
Control	31	25	27	24
1	38	44	42	35
2	44	40	49	41
3	40	38	41	37
4	36	39	38	33
5	35	32	37	32
6	28	29	30	25
7	30	28	29	25
8	26	26	27	23
9	24	22	25	25
10	24	22	22	21
F Test	Significant	Significant	Significant	Significant
SE(M) ±	1.98	1.94	1.83	2.53
C.D. at 5% level	5.84	5.72	5.40	7.48

when conditions are most favorable, which implies adequate moisture, and aeration (Garreti, 1981). In present studies, due to the incorporation of wheat husk, in soil above 2% w/w may have created unfavorable conditions for fungal growth and active metabolic activities. As regard actinomycetal count (Table 3) was found to be increase linearly along with increase in the concentration of wheat husk upto 5% w/w level and decreases there after. It was observed that 5% level of wheat husk incorporation showed significantly superior effect in increasing actinomycetal population ($51x10^5$ /g) in vertisol over control treatment, after 20th day of incubation. Actinomycetes in soil are relatively sensitive to acidity and favors alkaline or neutral pH (Wakesman, 1961). However in the present investigation the soil acidity generated after the amendment of wheat husk at 5% w/w level and above may have suppressed the actinomycetal growth. The results on the present study are more of less similar with the experimental findings of Subhadra and Prasad (1996), they have stated that application of wheat husk significantly increased bacterial population in soil.

Simultaneously, the effect of graded level of wheat husk amendment on SVI in wheat was studied (Table 4). It shows that the seed germination percentage increases with increase in the concentration of wheat husk. However, only upto 2% level of wheat husk, above which the germination% decreases. It was observed that above 4% w/w level of wheat husk the germination was absent.

Statistical analysis reveals that the wheat husk incorporation showed insignificant effect in seeding development over control. During the decomposition of wheat husk, unfavorable compound might have generated in the soil. It may be the probable reason for inhibiting the growth of seedling. The results on present studies may

Table - 3: Effect of graded levels of wheat husk amendment on actinomycetal count in vertisol

Treatment Wheat husk w/w (%)	CFU (10^7 /g) of soil Incubation period (days)			
	Initial	**10**	**20**	**30**
Control	23	20	19	30
1	22	19	31	35
2	25	22	34	38
3	29	26	38	42
4	34	31	43	46
5	42	39	51	44
6	37	34	46	39
7	33	30	42	35
8	32	28	39	31
9	26	22	33	26
10	26	20	30	26
F Test	Significant	Significant	Significant	Significant
SE(M) ±	1.99	2.07	1.79	2.12
C.D. at 5% level	5.86	6.12	5.29	6.26

Table - 4: Effect of graded levels of wheat husk amendment on root length, shoot length, germination % and seedling vigour index in wheat on 30^{th} day

Treatment wheat husk w/w (%)	Root length (cm) (mean)	Shoot length (cm)(mean)	Germination count (mean)	%	SVI
Control	6.6	13.2	8.0	80	1584
1	5.9	15.0	7.0	70	1463
2	5.5	12.4	8.0	80	1432
3	4.0	6.0	3.0	30	300
4	-	-	-	-	-
5	-	-	-	-	-
6	-	-	-	-	-
7	-	-	-	-	-
8	-	-	-	-	-
9	-	-	-	-	-
10	-	-	-	-	-
F Test	NS	NS	-	-	-
SE(M) ±	-	-	-	-	-
C.D. at 5% level	-	-	-	-	-
NS- Non-significant.	-	-	-	-	-

shows variations in soil other than vertisol as well as for plants other than wheat. Our results are in acquisition with the experimental findings of Patrich *et al.* (1984), they have stated that decomposition of plant residue in soil may have either favorable unfavorable effect on plant growth, further they mentioned that during decomposition of plant residues, phytotoxic effect induced reduction in the growth of seedlings.

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