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EFFECT OF SOME WILD PLANTS LEAVES AND FLOWER POWDER ON THE GROWTH AND YIELD PARAMETERS OF RICE CV IRRI-6

M.A. AHMEDANI[1], S. YASMIN[2], M.A. ARAIN[1], K.H. SHAH[1], M. SUHAIL[2] AND M.A. NAHYOON[1]

[1]*Nuclear Institute of Agriculture, Tando Jam, Sindh, Pakistan*
[2]*Institute of Botany, University of Sindh, Jamshoro, Sindh, Pakistan*

Abstract

Pot studies were conducted to observe the effect of indigenous plants such as *Prosopis glandulosa, Cassia angustifolia, Azadirechta indica* and *Sphaeranthus indicus* on the growth, yield & quality parameters of rice cultivar IRR1-6. Powdered form of indigenous plants (leaves and flowers) was incorporated @ 2000 kg/ha into the soils belonging to four cropping histories i.e. orchard, kallar grass, wheat & rice fields. Pots were arranged in RCB design with four replicates. The data were collected on growth, yield and grain and straw nitrogen contents. The plant treatments, applied to all the four soils resulted in diversified environments for the rice crop parameters. Variability however depended on the nature of soils used. Among the soils tested orchard and wheat soils were found to provide most favourite soil rhizosphare for rice growth in the form of good soil structural conditions & high organic matter contents. Treatment with *P. glandulosa* has a profound effect on parameters of rice growth and yield as compared to the other treatments. Among rice quality parameters grain and straw nitrogen contents were improved over the control due to the wild plants treatment under various soils.

Introduction

Intensive cultivation has depleted soil nutrients especially nitrogen. Our soils are calcareous in nature and are deficient in organic matter (<1%), these deficiencies are to be compensated by synthetic fertilizers for having a better crop yield (Sahrawat, 1980). A substantial portion of fertilizers applied to the soils is lost through various ways and only about 30-40% is absorbed by the plants (Biederbeck *et al.,* 1996; Al-Kanani *et al.,* 1990; Becker *et al.,* 1994).

In many intensive agricultural systems, coated fertilizers, synthetic nitrification inhibitors, and compound fertilization are attractive proportions to maximize fertilizer use efficiency (Hendrickson & Douglas, 1993). But heavy cost of such compounds has become prohibitive for their frequent and economic use. Sahrawat (1980) has suggested that high costs of chemical amendments may reduce their use and low cost readily available materials could be used to advantage. Indigenous plant material, because of their easy availability and bactericidal potentials hence may prove to be promising method in controlling nutrient cycling by controlling the microbial activity of the soil; as decomposition of organic materials in the soil is a heterotrophic microbial regulation (Smith & Paul, 1990). Nutrient cycling through straw/green manure incorporation is widely practiced in modern agriculture (Mehlar & Hemamda, 1993; Becker *et al.,* 1994). Among various byproducts of plant origin are certain chemical compounds, proteins etc., released into the soil through active plant roots (Bremer & Kessel, 1992; Carter & Rennie, 1984).

Corresponding author's E-mail: dani4nia@yahoo.com

A number of plants with bactericidal activities has also been reported (Chopra, 1958; Munro, 1966; Modan *et al.*, 1972; Maryam *et al.,* 1972, *1973;* Baqir *et al.,* 1985, 1987; Hussain *et al.,* 1986). These plants can modify the soil environments for microbial growth. Fluctuations in the microbial activity may have a considerable influence on plant available nutrients, thus may increase the efficiency of fertilizer (Felsot & Dzantor, 1995).

Physico-chemical characteristics of the soil play a vital role in soil nutrient cycling. Among the various factors involved; cropping histories (Dick *et al.,* 1988, Doran *et al.,* 1990), soil amendments (Antill *et al.,* 1993; Badida & Alcaniz, 1993), soil type (Palma, 1986), soil pH (Monreal *et al.,* 1986), soil organic matter (Medina & Radel, 1988), soil organic carbon (Batjes, 1996), soil nitrogen (Hector & Westerman, 1989) and soil texture (Singh & Ram, 1987) have a special influence.

The current population growth rate of Pakistan is the highest among the nine most populous countries of the world. This demands a simultaneous increase in the agricultural production. Agriculture sector would be making into higher orbit of technology including efficient use of synthetic fertilizers and increased use of organic materials (Batjes, 1996).

The present investigation was conducted to see the influence of the residues of some indigenous plants reported for having bacteriostatic and bactericidal effects. The study reported here is a part of efforts for efficient use of urea fertilizer applied to the crops and cropping systems prevalent in different areas under study.

Materials and Methods

Soil sampling: Soil samples were collected from four specific cropping fields of Atomic Energy Agricultural Research Centre (N.I.A) Tando Jam experimental farm. The fields selected were wheat, rice, orchard and kallar grass field soil. Bulk of soil sample was collected at the top 0-15 cm layer from above cited four different fields reserved for specific cropping system for many years. The soil samples were taken with the help of Iron Auger having 6" diameter. Necessary care was made to avoid contamination during sample preparation and subsequent analysis. Four spots were selected for the sampling. Soil collected from various spots was mixed together to make one homogenous sample. The polythene bags (12" x 8") containing soil samples were brought to the laboratory & samples were air dried for 48 hours in a glass house. Air-dried samples were ground to pass through a 2-m.m sieve. The samples were then stored in covered plastic jars at room temperature.

Plant sampling: The plants reported by Baqir *et al.,* (1985, 1987) known to have bactericidal properties were collected from fields around Tando Jam. The following plants residue were used for each soil samples: (1) *Prosopis. glandulosa (2) Cassia. angustifolia (3) Azadirechta. indica* and *(4) Sphaeranthus. indicus.* The leaves of first three plants and flowers of the fourth one were used. The plant material was brought to the laboratory and washed several times with tape water. The material was then oven dried for 48 hours at 70^0 C. The dried plant material was crushed and ground in a mechanical grinder to pass through 20 mesh sieve and stored in plastic screw capped bottles.

Arrangement of pots: Eight kg soil was taken in earthen pots in four replicates for every treatment. A total of three sets of pots were arranged, each pot was clearly marked with number allotted to these pots indicating the soil used and treatment given. The plant material, @ 2000kg/ha, was mixed thoroughly into soil of each pot. A basal dose of phosphorus was added @ 200 kg/ ha in the form of single super phosphate. Nitrogen was applied in two splits @ 100 kg N per hectare in the form of urea, first half at the time of

sowing & remaining second half was provided at flag leaf emergence. Selected seeds of rice variety IRRI-6 were treated with 1 % Sodium hypo chlorite (NaOCl) for 24 hours, rinsed thoroughly with distilled water before placing them on filter paper in a plastic bucket for germination. After 10 days of germination seven seedlings were transplanted in each pot containing various plant residues. The three sets of pots thus made were then placed at their proper place. While the course of study following schedule was experienced.

Sampling from set-1: From the pots of 1st set, after two weeks, plants were thinned to 4 plants per pot, which were allowed to grow up to maturity. Following observations were recorded.

1. Plant height at the tillering stage and number of tillers at the time of maturity.
2. Fresh weight of straw.
3. Dry weight of straw.
4. Panicle length.
5. Panicle dry weight.
6. Rice grain and straw Nitrogen.

Sampling from set-II & set-III: Soil and plant samples were collected from potting set ii and iii at different time intervals under following schedule.

i) At a day interval for 1st week,
ii) At a week interval for further 6 weeks,
iii) At the time of crop harvest.

Soil & plant analysis: All the soil samples collected from NIA experimental farm Tandojam were analyzed for some physico-chemical properties by using standardized methods (Table 1). Texture was determined by Hydrometer method as given by Boyoucos (1962), electrical conductivity (1:5 soil-water extract) on Conductivity meter, pH (1;5 soil- water extract) on pH meter, organic matter by Walkaley-Black method (Walkaley, 1947), total Nitrogen by Kjeldhal's method as described by Bremner (1970).

Results and Discussion

Experiments on the use of indigenous plants (@ 2000 kg/ha) such as *P. glandulosa, C. angustifolia, S. indicus* and *A.indica* were conducted in pots using soils of four different cropping histories i.e., orchard, kallar grass, wheat and rice field soils, by growing rice crop Cv; IRRI-6. Part of studies carried out were on the growth parameters such as rice fresh weight, dry weight, panicle length, plant height, tiller number at harvest; and rice quality parameters in terms of grain and straw nitrogen. The cumulative results have been provided in Tables 1-8. Treatment with *P. glandulosa* has a profound effect on parameters of growth and yield in all soils tested as compared to the other treatments, suggests the availability of additional nutrients, the rest of the plant treatments on the other hand had very little effects on growth and yield parameters of rice under different soils during the growth of rice crop. The observations demonstrated were in consistent with the work reported by Martin *et al.,* (1993) and Mary & Dick, (1994).

Table 1. Effect of various indigenous plants powder (incorporated @ 2000kg/ha) in soils having different cropping histories on rice fresh weight.

Treatments	Soil types				
	Orchard	**Wheat**	**Rice**	**K. grass**	**Average (g)**
Control	D 91.98 b	C 57.13 c	B 140.78 a	C 51.60 c	85.37 D
P. glandulosa	A 175.05 a	A 115.53 b	A 174.38 a	A 113.13 b	144.52 A
C. angustifo-lia	C 121.58 b	AB 99.65 c	B 145.73 a	AB 102.70 c	117.41 C
S. indicus	B 139.48 a	B 95.60 b	B146.65 a	B93.93 b	118.86 BC
A. indica	A 159.25 a	B 96.68 b	B152.13 a	B 86.30 b	123.69 B
Average	**137.43 B**	**92.93 C**	**151.93 A**	**89.53 C**	

Note: i) Results are recorded in grams; **ii)** Means followed by different letters are significantly different from each other at 1% level. Small and capital letters show intra and inter column significance.

Table 2. Effect of various indigenous plant powders (incorporated @ 2000kg/ha) in soils having different cropping histories on rice dry weight.

Treatments	Soil types				
	Orchard	**Wheat**	**Rice**	**K. grass**	**Average (g)**
Control	AB 45.25 a	C 26.98 b	C 50.58 a	C 25.75 b	37.14 D
P. glandulosa	A 87.93 a	A 58.48 b	A 86.70 a	A 56.08 b	72.29 A
C. angustifo-lia	C 59.40 b	AB 54.68 b	B 72.08 a	AB 50.50 b	59.16 C
S. indicus	B 71.40 a	AB 49.03 b	B 72.48 a	AB 47.10 b	60.0 BC
A. indica	AB 79.58 a	B 48.20 b	B 78.00 a	B 42.48 b	62.0 B
Average	**68.71 B**	**47.47 C**	**71.97 A**	**44.38 D**	

Note: i) Results are recorded in grams; **ii)** Means followed by different letters are significantly different from each other at 1% level. Small and capital letters show intra and inter column significance.

Table 3. Effect of various indigenous plant powders (incorporated @ 2000 kg/ha) in soils having different cropping histories on rice panicle length.

Treatments	Soil types				
	Orchard	**Wheat**	**Rice**	**K. grass**	**Average (g)**
Control	A 14.08 a	A 14.35 a	A 13.35 a	A 14.94 a	14.18
P. glandulosa	B 11.92 b	A 13.76 ab	A 13.10 ab	A 15.17 a	13.33
C. angustifo-lia	A 14.70 a	A 11.69 b	A 14.61 a	A 15.53 a	14.13
S. indicus	A 14.65 a	A 13.19 a	A 13.25 a	A 16.03 a	14.28
A. indica	AB 13.71 b	A 12.70 b	A 11.86 b	A 17.63 a	13.98
Average	**13.68 B**	**13.14 B**	**13.23 B**	**15.86 A**	

Note: i) Results are recorded in cm; **ii)** Means followed by different letters are significantly different from each other at 1% level. Small and capital letters show intra and inter column significance.

Table 4. Effect of various indigenous plant powders (incorporated @ 2000kg/ha) in soils having different cropping histories, on rice panicle dry weight.

Treatments	Soil types				
	Orchard	**Wheat**	**Rice**	**K. grass**	**Average (g)**
Control	AB 16.85 a	C 9.65 b	A 16.65 a	AB 17.20 a	15.09 C
P. glandulosa	A 19.43 a	A 18.95 a	A 16.95 ab	BC 14.78 b	17.53 A
C. angustifo-lia	C 13.30 a	B 12.38 a	B 14.20 a	C 13.03 a	13.23 D
S. indicus	AB 17.50 a	B 13.03 b	A 16.78 a	A 17.85 a	16.29 B
A. indica	B 15.98 a	BC 11.08 b	A 17.75 a	AB 16.88 a	15.42 C
Average	**16.61 A**	**13.02 B**	**16.47 A**	**15.95 A**	

Note: i) Results are recorded in grams; **ii)** Means followed by different letters are significantly different from each other at 1% level. Small and capital letters show intra and inter column significance.

Table 5. Effect of various indigenous plant powders (incorporated @ 6 ton/ha) in soils having different cropping histories, on rice plant height at maturity stage.

Treatments	Soil types				
	Orchard	Wheat	Rice	K. grass	Average (g)
Control	D 74.50 a	B 71.75 b	BC 85.5 a	C 71.75 b	75.8 D
P. glandulosa	A 96.75 a	B 82.00 b	A 93.5 a	A 84.25 b	89.13 A
C. angustifo-lia	C 79.75 b	B 83.25 b	B 88.25 a	BC 74.50 c	81.4 C
S. indicus	CD 78.00 b	C 75.50 b	C 82.00 a	C 71.25 c	76.0 D
A. indica	B 85.25 b	A 92.00 a	C 82.5 b	B 78.00 c	84.44 B
Average	**82.85 B**	**80.90 C**	**86.35 A**	**75.95 D**	

Note: i) Results are recorded in cm; **ii)** Means followed by different letters are significantly different from each other at 1% level. Small and capital letters show intra and inter column significance.

Table 6. Effect of various indigenous plant powders (incorporated @ 2000kg/ha) in soils having different cropping histories on rice tiller number at harvest.

Treatments	Soil types				
	Orchard	Wheat	Rice	K. grass	Average (g)
Control	B 25.75 b	C 19.50 c	B 30.00 a	B 17.50 c	23.19 D
P. glandulosa	A 34.75 a	A 37.50 a	A 35.00 a	A 29.50 b	34.19 A
C. angustifo-lia	A 32.75 a	B 24.25 b	A 34.00 a	A 27.25 b	29.56 B
S. indicus	A 31.75 a	B 25.75 b	AB 32.50 a	B 18.25 c	27.06 C
A. indica	A 35.25 a	BC 23.00 c	AB 31.25 a	A 28.50 b	29.50 B
Average	**32.05 A**	**26.00 B**	**32.55 A**	**24.20 C**	

Note: Means followed by different letters are significantly different from each other at 1% level. Small and capital letters show intra and inter column significance.

Table 7. Effect of various indigenous plant powders (incorporated @ 2000kg/hac) in soils having different cropping histories) on rice grain N.

Treatments	Soil types				
	Orchard	Wheat	Rice	K. grass	Average (g)
Control	A 0.98 c	B 1.89 a	A 1.59 b	C 1.11 c	1.39 B
P. glandulosa	A 0.98 c	C 1.50 a	AB 1.37 a	BC 1.30 ab	1.31 B
C. angustifo-lia	A 1.06 b	C 1.37 ab	B 1.21 b	A 1.61 a	1.34 B
S. indicus	A 0.99 c	A 2.29 a	B 1.21 b	AB 1.58 b	1.51 A
A. indica	A 1.15 b	C 1.55 a	B 1.16 c	A 1.69 b	1.39 B
Average	**1.07 D**	**1.72 A**	**1.30 C**	**1.46 B**	

Note: i) Results are recorded in %age; **ii)** Means followed by different letters are significantly different from each other at 1% level. Small and capital letters show intra and inter column significance.

Table 8. Effect of various indigenous plant powders (incorporated @ 2000kg/ha) in soils having different cropping histories on rice straw N.

Treatments	Soil types				
	Orchard	Wheat	Rice	K. grass	Average (g)
Control	AB 0.33 ab	C 0.26 b	A 0.41 ab	A 0.48 a	0.37 AB
P. glandulosa	AB 0.43 ab	A 0.53 a	A 0.32 b	AB 0.36 b	0.41 AB
C. angustifo-lia	AB 0.37 a	BC 0.31 a	A 0.38 a	AB 0.45 a	0.37 A-C
S. indicus	B 0.27 a	ABC 0.38 a	A 0.38 a	AB 0.41 a	0.36 A-C
A. indica	A 0.49 a	AB 0.46 ab	A 0.32 b	B 0.30 b	0.39 AB
Average	**0.37 a**	**0.39 a**	**0.36 a**	**0.40 a**	

Note: i) Results are recorded in %age; **ii)** Means followed by different letters are significantly different from each other at 1% level. Small and capital letters show intra and inter column significance.

Appendix-1. Soil physico-chemical properties of soils used for the pot experiments.

Soil location	Soil texture			Textural class*	pH	Tss m. moh	O.M %	N %	Urease ug/10g	Hydrogenase mg/kg
	Sand %	Silt %	Clay %							
Orchard	49.1	20.0	30.9	SCL	7	1.19	0.9	0.06	260	10.2
Wheat	33.2	33.0	33.4	CL	7	0.39	0.7	0.0	280	4.4
Cotton l	31.6	30.0	33.4	CL	7.	0.33	0.8	0.04	90	6.0
Rice	12.8	40.0	47.2	C	8.	0.35	0.9	0.05	90	7.8

Note: * = Cl= Clay loam, L= Loamy, C= Clay, SC= Silty clay, SCL= Silty clay loam

An interesting phenomenon was the better performance of rice in orchard & wheat soils compared to other soils by providing favorable environments for rice growth in the forms of good soil structural conditions and high organic matter contents (Appendix-1). Among rice quality parameters grain and straw nitrogen, contents (Tables 7 and 8) were improved over the control due to indigenous plant treatments under various soils. This may be due to the controlled/modified the process of nitrification as observed during incubation experiments (data not presented) which enhanced the period of nitrogen availability.

During these studies we also looked on the behavior of soil enzymes related to soil N cycling i.e., urease and hydrogenase. We observed that the variability in rice yield and growth parameters in different soils under different plant residue treatment is to be expected because of treatment influence on urease activities and the variability of soil nutrient contents inherently present in these soils (author's un published data). Urease activity was retarded by indigenous plant treatments was followed by simultaneous decrease in hydrogenase activity (index of soil biological activities); Clearly demonstrated the effects because of restrictions in active soil microbial growth activities. Perucci *et al.,* (1982) also presented the data showing that both urea-N losses and urease kinetic parameters were modified by the incorporation of vegetable residues into the soil. The data suggest that the agronomic practice of incorporating crop residues into soil may modify the soil characteristics that determine the urea-N losses through urea hydrolysis and support the hypothesis that urease activity increases when organic matter is added to the soil. The inhibition of soil urease in rice field soil can be attributed to the higher ionic strength of the soil as determined by EC values (Appendix-1). These results are in consistent with the findings of Frankenberger & Bingham (1982) who reported that higher ionic concentrations present in the soils invariably inhibit the biological activities of the soil & degree of variation depends upon can be explained in terms of quantity of salts present as reported by Singh & Bajwa, (1886) and Frankenberger & Bingham, (1982). These studies advise an attractive opportunity of a simplified experimental technique to the farmers, the use of dried & powdered, easily available plant material for regulating some important stages in soil nutrient transformations thus increasing fertilizer use efficiency of urea fertilizer for the crop improvements.

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