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Influence of different organic manures on the yield of *plantago ovata* forsk and post-harvest yield of residual crop of *digera muricata* mart

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***Abstract*---**Pot experiments were conducted to evaluate fertilizing capacity of different organic manures on the yield of Isabgol (*Plantago ovata*) plant. Experiments were conducted using different organic manures (Kultha Powder, Til Khali, Vermi-compost) and their fertilizing capacity were compared with control. The fertilizing capacities of different organic manures were assessed on the basis of fruit yield and dry matter yield of Isabgol plant. Study observed low levels of micronutrients (Copper and Iron) in post soil analysis with *Kultha* powder and *Til*, compared to the control, this may be attributed to the increased uptake of these micronutrients by the plant. This observation was further supported by the higher dry matter yield and greater number of fruits in the *Kultha* and *Til* treated pots. HPTLC analysis was also conducted to assess the chemical constituents of the test plant grown under the influence of different manures. The active constituents were found to be highest in the *Kultha* treated plants, followed by those treated with *Til khali*. Study suggested *Kultha* powder and *Til as promising manure compared to others for the cultivation of* Isabgol *plant. Impact of tested manures on the* post-harvest yield of residual crop of *Digera muricata* was also evaluated and study observed that *Kultha* powder significantly influences plant yield of residual crop of *Digera muricata* in terms of heights.

***Keywords*---**Isabgol, Organic Manures, Fertilizer, Soil, Vermi-compost.

Introduction

A large number of medicinal plant species are used in traditional system of medicines throughout the world. India is known for its various traditional systems of medicines that have been utilized since time immemorial. The World Health Organization has estimation that 80% of the population depends upon herbal medicines for basic need of health restoration (World Health Organization, 2002; Chopra, Nayar, & Chopra, 1956).

Isabgol is one of the cultivated medicinal plants which is cultivated for seeds and husk. Isabgol belonging to family *Plantaginaceae*, it is an annual herb that attains a height of 30-50 cm. The husk is epidermal polyhedral, which is considered as

main plant part that has mucilaginous compound used for the treatment of constipation (Chopra, Nayar, & Chopra, 1956; Kirtikar & Basu, 1935). Isabgol is one of the sources for foreign exchange; therefore, it was taken as a test plant for the current study. This work was undertaken to study the effects of Kultha powder, til, vermicompost and FYM (Farm Yard Manure) on micronutrients and physico-chemical parameters of soil (Kiran et al., 2022). The post harvest effect of these materials on soil property was assessed on the basis of improvement in crop yield of Isabgol.

Material and Methods

Experiment was conducted on test plant *Plantago ovata* Forssk (Isabgol). The treatments of various manures were given after forty five days of sowing. Treatments were replicated thrice and harvesting was done after 210 days. Pre and post harvest soil were subjected to physico-chemical analysis by various analytical methods. The treatments of various manures were given as follows:

1. FYM
2. Vermi- Compost
3. Kultha powder (*Dolichus uniflorus*)
4. Til (*Sesamum indicum*)
5. Control

Soil analysis Methods:
Soil Physico-chemical analysis was done at IGFRI, Jhansi, India using following methods:

Soil pH and Electrical Conductivity (EC):
Water suspension of 1:2.5 was used for soil reaction (pH) with a pH meter and its clear supernatant solution was used for determining electrical conductivity (Rhoades, 1982).

Organic Carbon
Organic Carbon was determined using chromic acid rapid titration method as outlined by Walkley and Black (1934) with slight modification (Walkley & Black, 1934).

Available Nitrogen (N)

- ✓ ***Apparatus required:*** Kjeldahl Digestion Assembly, Ammonia Distillation assembly.
- ✓ ***Distillation***: the Ammonia content of the digest was determined by distillation with excess of NaOH and absorption of the evolved NH_3 in the standard HCl.
- ✓ ***Volumetric Analysis****:* the excess of standard HCl was filtered against standard NaOH using Methyl Red as an indicator. The decrease in the multi equivalence of the acid was determined by acid- base titration which gives a measure of the N-content of the sample (Keeney & Nelson, 1982).

Available Phosphorus (P)

Available P was estimated by Olsen's method (Olsen, Cole, Watanabe, & Dean, 1954); the 0.5N sodium bicarbonate was used as reagent which pH was adjusted to 8.5. The reagent was prepared by dissolving 42gm of $NaHCO_3$ in Erlenmeyer flask, 50ml of Olsen's reagent 10.5 M $NaHCO_3$ adjusted to pH 8.5 and one teaspoon full of activated charcoal were added. The flask was shaken for 30 minutes and the contents were filtered immediately through filter paper (No. 41). 5ml of filtrated was taken out by pipette into a 25ml of volumetric flask and neutralised with dilute H_2SO_4 using p-nitrophenol as an indicator. After addition of few crystals of stannous oxalate a blue colour was observed in photoelectric colorimeter within 10 minutes at a wavelength of 730 nm. A blank was also run using same procedure without soil.

Available Potassium (K)
Available K was estimated by flame photometer using standard solution of potassium and diluted extract was used as sample (Miller & Donahue, 1990).

Micronutrient Analysis:
Micronutrient cations (Zn, Cu, Fe and Mn) were extracted from soil by 0.005 (M) DTPA using 1:2 soil: extractant ratio. After 2 h of shaking supernatant solution was collected through filtration. Micronutrient cations content in the solution was determined using atomic absorption spectrophotometer (AAS) Model AA700 (Patra, Anwar, & Chand, 2000; Anwar et al., 2005).

HPTLC-Analysis:
HPTLC analysis was also conducted to examine the chemical constituents of the test plant grown under the influence of various manures. HPTLC analysis was performed using 100 mg/ml methanolic extract of plant. Combination of Toluene: Ethyl acetate: Formic acid (7:3:0.2 V/V) was selected as mobile phase.

Residual Analysis:
Impact of tested manures on the post harvest yield of residual crop of *Digera muricata* was also evaluated in terms of improvement of plant height. The effect of different organic manures on the plant height of residual crop of *Digera muricata* was evaluated at 90 days of planting.

Results and Discussion

An experiment was conducted on the test plant *Plantago ovata* Forssk (Isabgol) to study the effects of various manures. The treatments, which included FYM, vermin-compost, kultha powder (*Dolichus uniflorus*), and til (*Sesamum indicum*), along with a control, were applied 45 days after sowing. Each treatment was replicated three times, and the plants were harvested after 210 days. Both pre- and post-harvest soil samples were analyzed for physico-chemical properties using various analytical methods to assess the impact of the manures.

Isabgol was taken as the main crop to evaluate effects of manures on the crop yield. Plants were harvested and post harvest soil samples were analyzed for the

micronutrients contents and physico-chemical parameters. **Figure 1** depicted seeds sowing of main crop (Isabgol).

Figure 1: Seeds sowing of main crop (Isabgol)

Effects of experimental manures on the no. of fruits of test plant reported in **Table 1.** The average number of fruits per treatment, based on three replications, showed that the FYM treatment resulted in the highest fruit count with 81 fruits, followed by *Kultha* powder with 67 fruits, *Til khali* with 57.66 fruits, the control group with 49.66 fruits, and vermicompost with the lowest count of 34.33 fruits.

Table-1: Effects of experimental manures on the no. of fruits of test plant

Treatments	Average of three replications (No. of fruits)
Kultha powder	67
Til khali	57.66
FYM	81
Vermi Compost	34.33
Control	49.66

Effect of experimental manures on the yield of dry matter of test plant is depicted in **Table 2.** This showed that vermicompost resulted in the highest average dry weight at 85.55 grams, followed by *Kultha* powder with 83.99 grams, FYM with 81.00 grams, *Til khali* with 79.21 grams, and the control treatment with the lowest dry weight of 66.00 grams.

Table 2: Effects of experimental manures on the yield of dry matter of test plant

Treatments	Average dry weight in gm
Kultha powder	83.99
Til khali	79.21
FYM	81.00
Vermi Compost	85.55
Control	66.00

The findings of physico-chemical analysis of post-harvest soil of Isabgol is reported in **Table 3**, which revealed lower level of available Nitrogen, Phosphorus and Potassium in case of Vermi-compost, Kultha powder, Til khali treated pots in comparison to control and FYM. This could be due to higher uptake of Nitrogen by test plant which also reflected in table 1, which indicted higher yield of dry matter and maximum number of fruits in Vermi-compost, Kultha powder and Til khali treated pots.

Table 3: Physico-chemical analysis of post-harvest soil of Isabgol

Parameters	FYM	Vermicompost	Kultha powder	Til khali	Control
pH	7.9	7.8	7.8	7.9	8.3
EC (ds/m)	0.3	0.2	0.2	0.2	0.1
O.C. (%)	1.1	1.1	1.0	1.0	0.74
Available-N (kg/ha)	269.7	250.88	240.84	253.80	179.38
Available-P (kg/ha)	54.28	56.37	66.64	59.09	30.73
Available-K (kg/ha)	483.84	509.60	462.56	485.33	437.92

The results of micronutrients analysis of the post harvest soil is depicted in **Table 4**, which revealed highest value of Copper in post harvested soil when plant was cultivated using FYM and Vermicompost. This could be due to the abundance of Copper in the nutrients found in the fertilized soil.

Table 4: Micronutrients analysis of the post-harvest soil

S. No.	Treatments	Micronutrients Contents (ppm)			
		Copper-Cu	Mangnese-Mn	Iron-Fe	Zinc-Zn
1.	FYM	0.73	7.3	10	1.70
2.	Vermicompost	0.65	5.7	8.0	1.10
3.	Kultha powder	0.58	5.5	7.0	.61
4.	Til khali	0.57	5.6	7.8	.94
5.	Control	0.61	4.7	7.8	.83

As shown in the above Tables, the lower value of micronutrients (Copper and Iron) in Kultha powder and Til treated pots in comparison to control could be due to the higher utilization of these micronutrients by the plant Isabgol (Kiran et al.,

2022; Anwar et al., 2005). These findings also supported by the high yield of dry matter and number of fruits in case of Kultha and Til treated pots.

HPTLC-Analysis was also performed to examine the chemical constituent of test plant grown under the influence of different manures. The active constituents were found to be highest in case of Kultha, followed by Til khali treated Isabgol plants (**Figures 2)**.

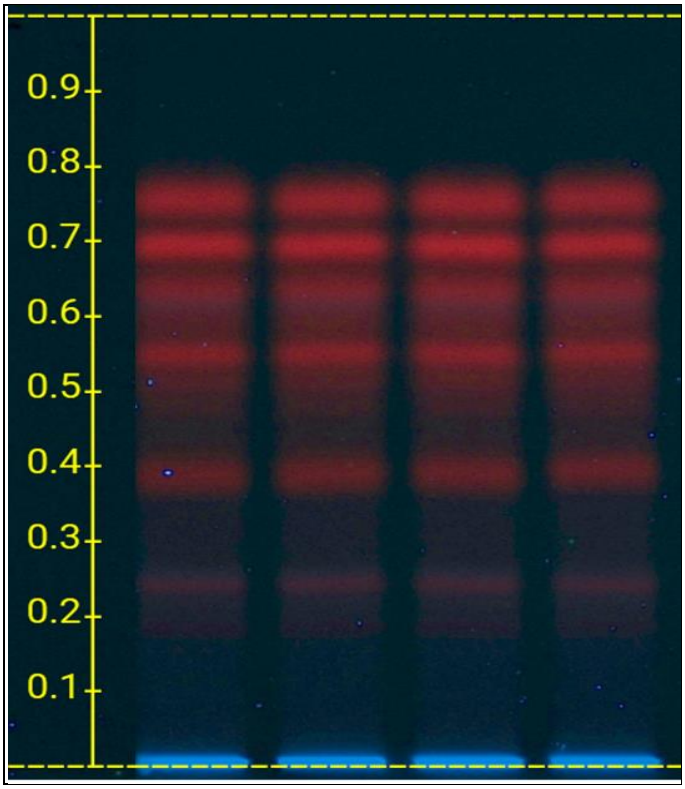

Figure 2: HPTLC of *Plantago ovata* Forsk Isabgol

As mentioned in figure 2 there are four different tracks of sample of plant extract on HPTLS plates, first tract was for Vermi composed treated plant, second track was of cow dung manure treated plant extract, third and fourth tracks were of Kultha Powder and Til oil treated plant respectively. These eluted spots/tracks were further subjected for 3D densitogram analysis which revealed highest constituent in Kultha treated plant as depicted in **Figure 3**.

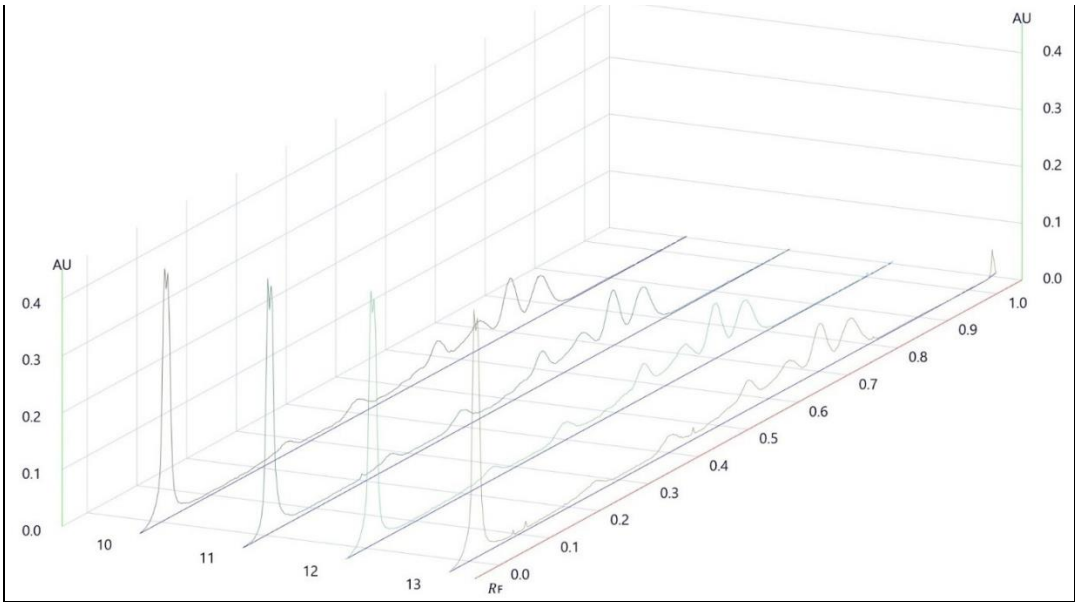

Figure 3: 3D Densitogram of HPTLS analysis of plant extracts at UV 366 nm

Residual Analysis

The impact of tested manures on the post-harvest yield of the residual crop of *Digera muricata* was assessed with a focus on the improvement of plant height. The study evaluated plant height at 90 days after planting across three replicates (R1, R2, and R3), calculating the average plant height for each treatment. Among the various organic manures tested, Kultha powder demonstrated a significant positive influence on plant height in the residual crop as depicted in **Table 5**. The results suggest that Kultha powder enhances plant growth and yield, specifically by promoting height, which is a critical factor in agricultural productivity. This effect could be attributed to the nutritional profile of Kultha powder, which may improve soil fertility and provide essential nutrients to the plants.

Table 5: Residual Effect of Different Organic Manures on the Plant Height (cm.) of Residual Crop of *Digera muricata*

S. No	Treatments	Plant Height after 90 days in cm. (three replicates)			Average of three replicates
		R1	R2	R3	
1	Kultha Powder	90	94	87	90.33
2	Til Khali	88	86	87	87.00
3	FYM	88	89	88	88.33
4	Vermicompost	90	88	87	88.33
5	Compost	80	83	82	81.67

Conclusion

An experiment was carried out on the test plant *Plantago ovata* Forssk (Isabgol) to examine the impact of different types of manures which included farmyard manure (FYM), vermicompost, kultha powder (*Dolichus uniflorus*), and til (*Sesamum indicum*), in addition to a control group. These treatments were applied 45 days post-sowing. The study found lower levels of Copper and Iron in soils treated with *Kultha* powder and *Til* compared to the control, likely due to higher nutrient uptake by the Isabgol plant. This was supported by greater dry matter yield and more fruits in these treated pots. HPTLC analysis also revealed the highest active constituents in *Kultha* treated plants, followed by those treated with *Til khali*. The study concluded that *Kultha* powder and *Til* are promising manures for Isabgol cultivation. The impact of various tested manures on the post-harvest yield of the residual crop of ***Digera muricata*** was evaluated, with a specific focus on plant height. The study observed that **Kultha powder** significantly influenced the yield of the residual crop in terms of increased plant height. This finding suggests that Kultha powder serve as effective organic manure for promoting growth and improving the overall yield of plant.

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