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Evaluation of Different Sources of Nitrogen and Bio-Fertilizers on Growth and Yield of Isabgol (*Plantago ovate*)

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ABSTRACT

A field experiment was conducted during the year 2016-17 at the Department of Plantation, Spices, Medicinal and Aromatic Crops,College of Horticulture, Mandsaur to study the effect of different sources of nitrogen and bio-fertilizers on growth and yield of Isabgol. The experiment was laid out inrandomized block design (RBD) with three replicationsand ten treatments comprised of graded levels of recommended dose of nitrogen (RDN), vermi-compost, FYM and bio-fertilizers (Azotobactor + PSB). The resultsindicated that the growth and yield of isabgol crop can be increased by treatment T2(50% RDN through urea and 50% RDN through vermi-compost (40 kg N/ha) + bio-fertilizers as Azotobactor + PSB 3 kg/ha each).

Key Words: Bio-fertilizer, FYM, Isabgol, Nitrogen, Vermi-compost, Yield.

INTRODUCTION

Isabgol (*Plantagoovate Forsk*.) is one of the important medicinal crop belongs to the family Plantaginaceae and important for its seed and husk which have been used in the indigeneous medicine for many centuries. (Tripathi *et al,* 2013). In India, it is commercially cultivated in the states of Madhya Pradesh, Gujarat and Rajasthan. In Madhya Pradesh it is largely grown in Neemuch and Mandsaur districts, covering an area of 7448 ha, production of 10427.2 t/ha and productivity of 1.4 mt (Anon, 2016). Although, Isabgol does not require heavy demand for nutrients but judicious use of fertilizers is of prime importance to achieve potential production. Nitrogen, phosphorus and potassium are the major primary nutrients required by the crop. Farm yard manure (FYM) is a rich in organic matter and can be supplemented with NPK fertilizers.FYM not only provides a variety of plant nutrients but also improves the physico-chemical and biological properties of soil. Besides improving the fertilizer use efficiency and soil health, low nitrogen losses due to slow release of nutrients from the organic manure is an added advantage.Bio-fertilizers having micro-organisms which are free living in soil and contribute directly or indirectly towards nitrogen and phosphorus nutrition of plants. They also produce hormones, vitamins and other growth factors required for the growth and development of plants (Tripathi *et al,* 2013). In the present agricultural practices, there are number of microbial inoculants used as bio-fertilizers.The dose of chemical fertilizers is minimized by using vermicompost and biofertilizers, which may reduce the cost of cultivation along with the increased yield.Therefore, the study was undertaken to study the effects of different sources of nitrogen and bio-fertilizers on growth and yield of Isabgol.

MATERIALS AND METHODS

The experiment was carried out at the Horticulture Experimental Farm, College of Horticulture Mandsaur during rabi 2016-17 season. The seeds of Isabgol (Jawahar isabgol 4) were sown in plot of 3 m × 3 m in a randomized block design in ten treatments and three replications with crop geometry (20 cm × 5 cm). The experiment comprised of 10 treatments combinations viz.,T1 (25%RDN through urea and 75% RDN through vermicompost (40 kg N/ha) +bio-fertilizers (Azotobacter + PSB 3 kg/ha each), T2(50%RDN through urea and 50%RDN through vermicompost (40 kg N/ha) + bio-fertilizers (Azotobacter + PSB 3 kg/ha each), T3 (75%RDN through urea and

25% RDN through vermicompost (40 kg N/ha) +biofertilizers (Azotobacter + PSB 3 kg/ha each), T4(25%RDN through urea and 75% RDN through FYM (40 kg N/ha) + bio-fertilizers (Azotobacter + PSB 3 kg/ha each), T5(50%RDN through urea and 50% RDN through FYM (40 kg N/ha) + biofertilizers(Azotobacter + PSB 3 kg/ha each), T6(75%RDN through urea and 25% RDN through FYM (40 kg N/ha) + biofertilizers (Azotobacter + PSB 3 kg/ha each), T7(100%RDN through FYM (40 kg N/ha) + biofertilizers (Azotobacter + PSB 3 kg/ha each), T8(100%RDN through vermicompost (40 kg N/ha) + bio-fertilizers (Azotobacter + PSB 3 kg/ha each), T9 (100%RDN through urea (40 kg N/ha) and T10(Control).The calculated quantities of manures and fertilizers were applied to the respective plots. The sources of nutrients were nitrogen (Urea), phosphorus (SSP) and potash (MOP) at the rate of 40: 30: 20 NPKkg/ha. Full dose of phosphorus and potash were applied as basal dose prior to sowing of isabgol. Nitrogen is applied in two split doses at 40 and 55 DAS. The calculated quantities of FYM, Vermicompost and Biofertilizer (PSB and Azotobacter) were applied as full dose. Bio-fertilizers were mixed with FYM. The seeds were used with the seed rate of 3-4 kg/ha and treated with Captan 2 g/kg seeds.

The plant height was measured from the ground level to the growing tip of the main stem at 30, 60 and 90 days after sowing (DAS).Thenumber of leaves, number of the tillers, n numbeofspikes and length of spikes from five randomly selected plants, each plot was counted at 60 and 90 DAS. Ten spikes were selected at random from the plant, which were used for seeds/spike and total seeds were counted. One thousand seeds were counted and weighed on electronic balance and recorded as test weight (g). Number of days was counted from sowing to till 100 per cent of spikes started drying in the plot and recorded as days to maturity. All the cleaned seeds obtain from individual plot were weighed. The straw yield was calculated by subtracting the seed yield (q/ha) from the biological yield (q/ha). The harvested and sun dried crop of each plot was weighed and the weight was recorded in g/plot and then converted into q/ha. The harvest index was obtained by dividing the economic yield (seed yield) from total biological yield and expressed as percentage. The data on different vegetative growth and yield parameters were recorded using five plants, which were selected randomly in the each plot and data were statically analyzed.

RESULT AND DISCUSSION

Growth attributes

The maximum plant height, number of leaves, number of tillers, number of spikes and length of spike were recorded with the application of 50 per cent RDN through urea and 50 per cent nitrogen through vermicompost (40 kg N/ha) + biofertilizers as azotobacter + PSB 3 kg/ha each (T2). The increase in plant height of isabgol may be due to the treatment combination of organic and inorganic nitrogenous fertilizers which maintain long term soil fertility. Similar results were also reported by Yadav *et al* (2003). The increase in number of leaves might be due to the production of more chlorophyll content with the application of balanced nutrition in the form of nitrogen and vermicompost and also due to production of plant growth regulators by bacteria in rhizosphere, where it is absorbed by roots. These results were in close conformity with the findings of Tripathi *et al* (2013) in Isabgol.

The higher number of tillers per plant might be due to increased growth of plant in the form of height and number of leaves, which accumulated more photosynthesis and thereby increased number of tillers per plant. These findings were in the close conformity with the findings of Raissi *et al* (2012) and Tripathi *et al* (2013) in Isabgol.The increased in number of spikes and length of spikes may be due to the fact that NPK, vermicompost and FYM application accelerated the development of leaf number, which are positively correlated with the number of spikes and length of spikes. Increased in length of spikes might have resulted because of increase in number of tillers per plant. Similar results were also reported by Tripathi *et al* (2013) in Isabgol.

Table 1. Effect of different sources of nitrogen and bio-fertilizers on growth parameters of Isabgol

Treatment	Plant height (cm)			Number of leaves/ plant		Number of tillers / plant		Number of spikes / plant		Length of spike (cm)	
	30 DAS	60 DAS	90DAS	60 DAS	90 DAS	60DAS	90DAS	60 DAS	90 DAS	60 DAS	90 DAS
T1	9.82	18.62	29.64	16.20	38.58	3.39	3.44	12.84	22.60	2.60	4.47
T2	11.84	25.17	40.37	29.73	56.20	4.08	4.21	15.73	31.94	3.75	6.11
T3	11.24	24.26	39.08	27.64	54.37	3.82	3.97	15.11	30.25	3.41	5.45
T4	9.14	18.43	29.30	15.50	37.66	3.30	3.55	12.17	22.55	2.40	3.93
T5	10.79	19.12	34.20	19.44	44.47	3.56	3.70	13.29	24.80	3.07	4.67
T6	10.56	19.10	34.05	18.17	42.32	3.49	3.63	13.07	24.04	2.91	4.57
T7	8.26	18.11	36.32	15.23	35.13	2.98	3.15	10.41	20.71	2.10	3.37
T8	8.58	18.37	29.21	15.38	35.86	3.09	3.38	11.74	20.45	2.17	3.63
T9	10.72	23.52	37.80	25.66	52.84	3.60	3.83	14.52	28.63	3.13	4.88
T10	8.04	16.12	23.18	9.92	24.52	2.68	2.79	10.13	17.90	1.77	2.11
S.Em. ±	0.16	0.19	0.32	0.41	0.30	0.05	0.04	0.18	0.30	0.07	0.18
CD at 5%	0.48	0.59	0.96	1.23	0.90	0.16	0.13	0.53	0.90	0.22	0.55

Table 2 . Effect of different sources of nitrogen and bio-fertilizers on yield parameters of Isabgol.

Treatment	Number of seed per spike	Test weight (g)	Days to maturity	Seed yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest index (%)
T1	75.24	1.70	116	7.07	22.25	29.32	24.14
T2	82.42	2.10	122	11.41	30.74	42.15	27.11
T3	80.04	1.95	120	9.32	26.13	35.45	26.30
T4	74.76	1.66	115	6.87	22.15	29.02	23.75
T5	76.33	1.80	119	7.15	23.53	30.68	23.30
T6	75.58	1.78	118	7.11	22.78	29.89	23.81
T7	71.61	1.54	111	6.66	21.21	27.86	23.89
T8	73.77	1.59	113	6.73	21.74	28.47	23.65
T9	78.31	1.88	119	7.17	23.57	30.73	22.24
T10	70.50	1.43	110	5.54	19.93	25.47	21.74
S.Em. ±	0.16	0.02	0.63	0.07	0.70	0.71	0.58
CD at 5%	0.48	0.06	1.8	0.21	2.10	2.11	1.72

Yield attributes and yield

In the present study it was observed that different sources of nitrogen and biofertilizers had significantly influenced the yield and yield attributes of Isabgol. The maximum number of seeds per spike, test weight, days to maturity, seed yield, straw yield, biological yield and harvest index were recorded with the treatment 50 per cent RDN through vermicompost (40 kg N/ha) + biofertilizers as azotobacter + PSB 3 kg/ha each. Increased in the number of seeds per spike might be due to the fact that vermicompost is expected to hasten plant development. Hence an increase in fruit set in present study is due to cumulative effect of balanced nutrition and vermicompost application.

The application of nitrogen with organic manure would increase the test weight. Organic manures plays a vital role in the process of grain filling through increase in leaf area of crop resulted in increased dry matter production by intercepting more sunlight. Similar results have also been reported by Firoozabodi and Baghizadeh (2013) in French psyllium and Karimzadeh and Omidbaigi (2004) in Isabgol. Days to maturity were significantly affected with the application of different sources of nitrogen and biofertilizers. Increased number of days to maturity might be due to increased growth of plant in the form of height and number of leaves, which accumulated more photosynthates and ultimately the more growth of the plant.

The integrated use of chemical fertilizer and manures increased the seed yield, straw yield and biological yield of isabgol. Application of 50 been RDN through urea and 50 been RDN through vermicompost (40 kg N/ha) +bio-fertilizers (Azotobacter + PSB 3 kg/ha each treatment recorded 11.41 q/ha seed yield which was significantly higher by 105.95 per cent over control. The FYM and vermicompost help in releasing humus forming microbes, nitrogen fixers and some growth regulators results in the production of more vegetative growth of plants. Ultimately, these characters had beneficial effect on higher seed yield. The PSB inoculation significantly affected the root shoot ratio of Isabgol and ultimately influenced the grain yield. PSB helps in reducing phosphorus fixation by its chelating effect and also solubilized the fixed phosphorus leading to more uptake of nutrients and reflected better yield attributes ultimately leads to higher seed and straw yield as reported by Singh and Singh (2004).

CONCLUSION

It may conclude that application of 50 been RDN through urea and 50 been RDN through vermicompost (40 kg N/ha) +bio-fertilizers(Azotobacter + PSB 3 kg/ha each)treatment significantly increased the growth and yield attributes and finally yield of Isabgol as compared to all treatments tested.

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