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IMPACT OF SOWING DATE AND FERTILITY LEVELS ON GROWTH PARAMETERS OF ISABGOL

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Abstract

Field experiment was conducted during *rabi* season 2005-2006 under Kymore Plateau region of Madhya Pradesh to study the "Effect of Planting time and fertility level on growth and yield of Isabgol *[Plantago ovata* (Forsk)]" by using with 12th treatment combination with 3 date of sowing (November 24, December 4, December 14) as main plot and 4 fertility levels (Cantrol, 25:12.5:15, N:P:K kg/ha. 50:25:30 N:P:K and 75:37.5:45 Kg N:P:K kg/ha. as sub plot treatments with 4 replications. Resulted that date of sowing significantly influenced the number of leaves and Leaf Area Index of Isabgol while number of tillers/plant and spikes/plant reduced with delayed sowing. The application of nutrient at higher level also resulted into the early initiation of panicles, flowers and fruiting and caused early physiological maturity. Higher seed yield was recorded with early sowing date (24, November) with the application of 50:25:30 NPK.

Key words : Sowing date, nutrient management, NPK, isabgol, medicinal crops, growth parameter.

Introduction

Isabgol [*Plantago ovata* (Forsk.)] or Psyllium is predominantly cultivated medicinal crop in Gujarat and in the whole world. Isabgol (2n = 8) belongs to family Plantoginace. It is a highly cross pollinated crop. The genus *Plantago* comprises of 200 species out of which 10 are found in India (Anonymous, 1969). It is an annual herb abounding warm temperate region between 26^0-30^0 N latitude (Stebbins and Day, 1967). In India produced annually from 27,100 ha area around 35,000 tonnes Isabgol. Nevely 26000 tonnes Isabgol are exported from India though around 70 organizations. All the mucilage is used as an ingredient in chocolate making, textile sizing, manufacturing cosmetics (Singh and Virmani, 1982) and setting and dressing hair (Rao, 1966). Isabgol is also a source of commercial gum (Farooqi, 1976). It can be used as a cervical dilator for the termination of pregnancy. Tribal's use Isabgol for several purposes, the Santhals use it to relieve pain and treat bronchitis (Jain and Tarafder, 1970).

In recent time due to the increasing realization of health hazards and toxicity caused by synthetic drugs and antibiotics, there has been a renewal of interest in the use of plant based drugs throughout the world. The international trade on herbs and herbal drugs is growing substantially due to this awareness. The most important agronomic management aspects for enhancing the crop productivity are time of planting, so that crop gets optimum condition to grow and nutrient management so that crop gets adequate supply of essential nutrients.

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Materials and Methods

A field experiment was carried out during *rabi* season of 2005–2006 at Research Farm of Department of Physics and Agro-meteorology, College of Agricultural Engineering, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.), India. It had low nitrogen (186 kg/ha), medium available phosphorus (15 kg/ha) and low available of potassium (210 kg/ha) along with low OC (0.60%) and neutral reaction (pH 7.5). Experiment was conducted by using 12 treatments consisted with 3 date of sowing *viz.*, D_1 (24, November), D_2 (4, December), and D_3 (14, December), as main plot treatment and 4 fertility level *viz.*, F_0 (Control), F_1 (25:12.5:15 NPK kg/ha), F_2 (50:25:30 NPK kg/ha) and F_3 (75:37.5:45 NPK kg/ha) as sub plot treatment an Split Plot Design with 4 replication.

The N, P and K were given through urea (46% N),

Table 1 : Influence of date of sowing and fertility levels on growth parameter of isabgol.

Treatments	Growth stages															
	Leaf Area Index					Crop Growth Rate (gm^{-2} day^{-1})					Relative Growth Rate (gg^{-1} day^{-1})					
	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS
November, 24	0.24	0.44	2.57	2.18	1.35	2.06	1.34	0.63	1.49	2.08	1.75	15.0	7.0	2.6	6.1	6.2	4.3
December, 4	0.41	0.78	1.38	1.58	0.90	1.84	0.96	1.19	2.73	2.15	0.39	15.0	5.0	5.3	10.0	3.3	0.9
December, 14	0.28	0.81	2.21	2.18	1.28	2.50	0.42	1.72	2.26	1.13	0.72	16.0	3.0	7.7	6.8	3.4	2.0
SEm±	0.09	0.20	0.28	6.34	0.16	0.80	0.17	0.13	0.27	0.28	0.31	1.0	0.8	0.5	0.9	0.8	0.94
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.0	1.10	NS	NS	NS	NS	NS	NS
Control	0.66	0.13	0.93	1.12	0.66	1.26	1.08	0.76	2.55	0.27	1.73	16.0	8.9	5.2	11.8	18	4.9
25:12.5:15 N:P:K Kg/ha	0.22	0.79	1.69	1.77	1.05	2.09	0.63	1.20	1.30	2.60	0.82	17.0	3.0	6.1	5.5	8.2	1.9
50:25:30 N:P:K Kg/ha	0.41	0.76	2.41	2.47	1.40	1.98	0.96	1.42	1.80	1.95	0.57	12.0	4.0	5.4	5.5	5.1	1.2
75:37.5:45 N:P:K Kg/ha	0.55	1.02	3.18	2.56	1.80	3.22	0.96	1.35	2.99	2.34	0.36	16.0	4.0	4.2	7.7	4.7	0.7
SEm±	**0.70**	**0.15**	**0.28**	**0.35**	**0.12**	**0.32**	**0.27**	**0.20**	**0.36**	**0.55**	**0.47**	**2.30**	**1.0**	**0.8**	**1.2**	**1.3**	**1.2**
CD (P=0.05)	NS	NS	NS	NS	NS	NS	0.78	0.59	1.05	NS	1.37	NS	3.0	2.39	NS	NS	3.5

diammonium phosphate (18% N + 40%P_2O_5) and muriate of potash (60% K_2O). Half of the N and full P and K were given as basal just at the time of sowing. Since the diammonium phosphate contains both N and P, hence quantity of desired N was adjusted with urea. The leaf area was recorded by automatic leaf area meter (CI-203) for obtaining, plant dry matter from each treatment, 5 plants were uprooted and then dried in on oven at 50^0C for 48 hours. Then these dried samples were weighed on an electronic balance. Studies on various physiological growth analyses were made at 30, 45, 60, 75 and 90 days after sowing as under Leaf area index expresses the ratio of leaf surface (one side only) to the ground area occupied by the crop (Watson, 1947).). The ratio of increase in dry matter per unit of dry matter present (Briggs *et al.*, 1920 and Blackman, 1968).

Results and Discussion

Yield attributes characters

Number of spikes per plant

The number of spikes/plant was maximum with sowing on D_1 (November 24) as compared to sowing on D_2 (December 4) and D_3 (December 14). The increasing fertilizer levels correspondingly increased the number of spikes per plant and each level varies significantly (table 1). The interactions between different dates of sowing and fertility levels were not significant for number of spikes per plant.

Length of spike

The length of spike did not vary significantly due to different dates of sowing and application of fertilizers at different levels as compared to control. The highest length of spikes was noted under F_3 (75:37.5:45 NPK Kg/ha) which clearly revealed that at early sowing was D_1 (24, November) application of KG N-P-K at 75:37.5:45 Kg/ha was optimum, however further higher dose of KG N-P-K may be tested. The interactions of dates and fertility levels were also not significant (table 1).

Number of tillers per plant

The number of tillers per plant was reduced due to delay in sowing but variations were non significant (table 1). The number of tillers per plant was 6.31 and 3.56 due to sowing on D_1 (November, 24) and D_2 (December, 4) respectively. The application of fertilizer significantly increased the number of tillers per plant with increasing levels of fertilizer. The highest number of tillers per plant was noted under F_3 (75:37.5:45 Kg N-P-K /ha) (6.8), while the lowest number of tillers was found under control (3.6).

Table 2 : Influence of dates of sowing and fertility levels on yield parameter of isabgol.

Treatments	Parameters				
	Harvest Index	Biological yield (Kg/ha)	Seed yield (Kg/ha)	Seed husk (g/plot)	Seed husk (%)
November, 24	18.40	2209	392	139	31.85
December, 4	13.67	1864	246	87	32.31
December, 14	12.18	2130	253	94	33.53
SEm.±	**1.03**	**134.57**	**40.84**	**15.57**	**0.51**
CD at 5%	**NS**	**NS**	**NS**	**NS**	**NS**
Control	15.97	1683	253	79	30.49
25:12.5:15 N:P:K (Kg/ha)	15.25	1963	309	101	32.74
50:25:30 N:P:K (Kg/ha)	15.10	2208	324	118	33.38
75:37.5:45 N:P:K (Kg/ha)	12.69	2417	303	130	33.51
SEm.±	**1.86**	**79.63**	**17.17**	**7.49**	**0.46**
CD at 5%	**3.44**	**NS**	**NS**	**NS**	**NS**

Table 3 : Influence of date of sowing and fertility levels on harvest index.

Treatment Fertility levels	Dates of sowing			Mean
	Nov. 24	Dec. 4	Dec. 14	
Control	22.05	15.35	10.50	**15.97**
25:12.5:15 N:P:K Kg/ha	18.12	14.07	13.57	**15.25**
50:25:30 N:P:K Kg/ha	21.80	13.05	10.50	**15.10**
75:37.5:45 N:P:K Kg/ha	18.65	12.20	14.22	**12.69**
Mean	**18.40**	**13.67**	**12.18**	

	Date of sowing	Fertility levels	DXF	FXD
SEm±	1.03	1.86	2.05	2.05
CD at 5%	NS	3.44	NS	NS

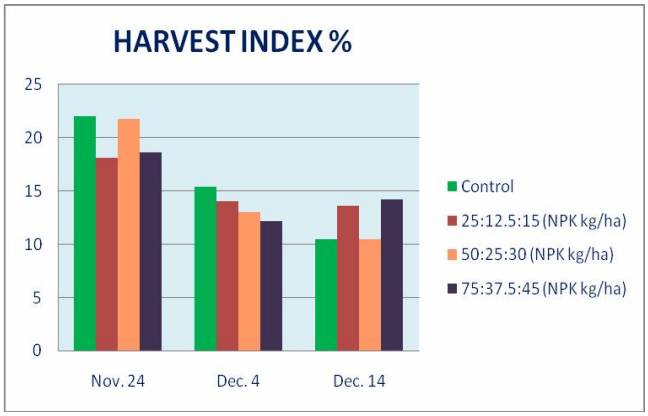
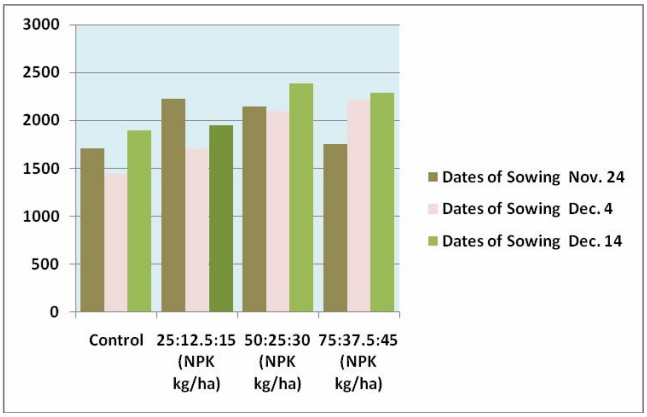


Table 4 : Influence of date of sowing and fertility levels on biological yield (kg/ha).

Treatment Fertility levels	Dates of sowing			Mean
	Nov. 24	Dec. 4	Dec. 14	
Control	1712	1446	1892	**1683**
25:12.5:15 N:P:K (Kg/ha)	2229	1708	1951	**1963**
50:25:30 N:P:K (Kg/ha)	2144	2089	2390	**2208**
75:37.5:45 N:P:K (Kg/ha)	1752	2213	2287	**2417**
Mean	**2209**	**1864**	**2130**	

	Date of sowing	Fertility Levels
SEm±	134.57	79.62
CD at 5%	NS	NS



Effect of growth by sowing date and fertility

The leaf area index increased gradually up to 60-day stage of the crop. It did not vary significantly due to dates of sowing as well as with application of fertilizers as noted at 60, 75 and 90 days after sowing. The effects of sowing dates at different fertility levels were significant at all the stage.

The maximum leaf area index was noted at 60-day stage, when sowing was done on D_1 (24 November) and D_3 (14 December) (table 2). The fertilizer application had increased Leaf Area Index significantly as compared to control at the stages of 30, 45, 75 and 90 days, but at

60-day stage the variations were not significant. The maximum leaf area index was noted with application of 75:37.5:45 kg N-P-K/ha as compared to lower levels. The variations in fertility levels at the same date of sowing were not significant. The crop growth rate was significantly affected due to dates of sowing and it vary significantly at 30, 45, 60 and 90-day stages. The analysis of Crop Growth Rate revealed that dry matter accumulation rate was higher at initial stage of 15 days than it declined and again increased at 60 and 75-day stage, further rate was reduced (table 2). The trend was similar under all the dates of sowing.

The variations in relative growth rate were non-significant due to sowing dates at 15, 30, 45 and 60-day stages. However, the differences were significant at 75 and 90-day stages. The effect of fertility levels on crop growth rate was significant at all the stages accept 30 and 75-day stages. The variation among fertility levels revealed that F_3 was effective to increase the crop growth rate significantly at 15 and 60-day stages as compared to other treatments. At 95-day stage all the fertility treatments were at par to control except F_3. The interactions were not significant on Crop Growth Rate except at 60-day stage. The variation due to dates at the same level of fertilizer application caused significant variations at 15, 60, 75 and 90-day stage (table 2). There was non-significant variation among F_1, F_2 and F_3 at 15, 60 and 75-day stages. The significantly higher RGR was noted under F_1 as compared to control. At 90-day stage significantly higher RGR was found under control as compared to F_2 and F_3. The interaction of dates of sowing and fertility levels were significant accept at 30, 60, 75 and 90-day stages.

Effect of yield by sowing dates and fertility

The harvest index less affected by different dates of sowing, numerically harvest index was maximum with sowing on 24 November and it reduced with further delay in sowing time (table 3). Different sowing dates significantly affected the biological yield. Sowing on November, 24 produced maximum biological yield (2209 kg/ha) which reduced as 1864 and 2130 kg/ha due to sowing December, 4 and 14, respective fertility level also significantly influenced biologically yield (table 4). Minimum biological yield of 1683 kg/ha was noted with zero fertility, which as 1963, 2208 and 2417 Kg/ha with the increase in fertilizer as F_1, F_2 and F_3, respectively. None of the interaction was found significant for this study.

The seed yield of Isabgol did not vary significantly due to dates of sowing, and fertilizer application and all the levels of fertilizers resulted the seed yield at par (table 3). The interactions were significant and F_2 and F_3 level gave significantly higher yields during first date of sowing that is 24 November. Further delay in sowing the yield was reduced significantly.

Under D_2, significantly higher yield was obtained with F_3 level of fertilizers, as compared to control while F_1 and F_3 were at par. Under D_3 higher yield was obtained at F_3 level of fertilizer dose as compared to control, while found was F_1 and F_2 at par.

The effect of the dates of sowing and fertility levels on yield of seed husk percentage was non-significant. The interactions of dates of sowing at different levels of fertilizers were significant the first date of sowing resulted in significantly higher husk yield percentage at F_1, as compared to control than other dates of sowing. The higher seed husk yield % was obtained when crop sown on 14, December with F_3 level.

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