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Yield optimization in isabgol through improved seed and fertilizer management practices in Transitional Plain of Luni Basin of Rajasthan

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Abstract

Field studies were conducted to evaluate the significant varieties/ genotypes and fertilizer management practices for harvesting the higher seed yield of isabgol in Transitional Plain of Luni Basin of Rajasthan. The maximum seed yield of 14.31 q/ha was provided by variety RI 89 followed by RI 3025 and GI 2 with 14.10 and 13.67 q/ha, respectively. The application of FYM @ 10 t/ha and biofertilizers (PSB & Azotobactor) along with chemical fertilizers @ 30kg N + 25 kg P2O5/ha provided 32.92% increase in seed yield of isabgol over farmer's practice. The use of improved seed with recommended seed rate of 5 kg/ha along with foliar spray of 1% soluble NPK at flowering stage also provided 27.35% increase in seed yield over farmer's practice.

Key words: Foliar nutrition, improved seed, integrated nutrient management, isabgol, seed yield.

Introduction

Isabgol (*Plantago ovata* Forsk; family Plantaginaceae*)* is a small herbaceous crop cultivated during rabi season. It is nearly a stem less soft hairy plant with large narrow linear leaves attains a height of 30-45 cm. The flowers are bisexual, tetramerous, anemophilous and protogynous and as such favouring out crossing (Barfa *et al.,* 2011). The seed epidermis is made of polyhedral cells whose walls are thickened by a secondary deposit which is the source of mucilage (Chopra, 1930). The coating of seed provides husk on mechanical milling. Husk is widely used in traditional and industrial pharmacology (Patel *et al.,* 1996) particularly in stomach disorder such as constipation, intestine irritation and dysentery (Mandal *et al.,* 2007; Viqar *et al.,* 2002). Isabgol husk forms gel and increases in volume many folds after absorption of water and stimulates normal bowel elimination. It is a dietary fibre which is effective in reducing cholesterol (Gupta *et al.,* 1994; Sagawa *et al.,* 1998). Looking to the importance and medicinal properties, isabgol has become a significant crop in international market with high export potential.

Isabgol requires moderately cool, dry and frost free clean weather conditions for proper growth and development. It is an excellent crop for input deficit situation because of its ability to grow on poor soils with minimum irrigation and fertilization. In India, isabgol is predominantly cultivated in Rajasthan and Gujarat states. In Rajasthan, the major area under isabgol cultivation has been covered by district Barmer, Jalore, Nagaur, Jodhpur and Jaisalmer. Presently, its cultivation is becoming more popular in western Rajasthan because of poor soil fertility, undulated topography and meagre availability of irrigation water. The method of irrigation mainly applied in isabgol particularly on undulated topography is sprinkler. In Rajasthan, isabgol has occupied average area of 123746 ha with annual production of 45813 tones and average productivity of 370 kg/ha (Anonymous, 2009-10).

Cultivation of suitable variety and fertilizer management are important aspects to harness higher crop yield. The farmer participatory action research is a very effective means for validation and dissemination of technology among farmers. Hence, keeping in view, a farmer participatory action research under RKVY programme was undertaken with the objective to validate the integrated nutrient management technology and foliar nutrition at farmer's fields with farmer participation.

Materials and Methods

The present study was conducted in Transitional Plain of Luni Basin of Rajasthan (zone IIb), which covers whole area of district Jalore and Pali, and part of district Jodhpur and Sirohi. In first experiment, seven varieties and improved genotypes of isabgol were evaluated for two years (2008-09 and 2009-10) in a randomised block design with 3

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replications at Agricultural Research Station, Keshwana, Jalore. The site is situated at latitude of 25°22'N and longitude of 72° 58'E, elevation 162 msl and has a tropical arid climate with mean annual rainfall of 421 mm. Soil at the site was clay loam slightly saline in reaction (pH 8.7).

Sowing was done on 07.11.2008 and 27.11.2009, respectively with standard seed rate. A fertilizer dose of 30 kg N and 25 kg P ha^{-1} was applied to the crop as per zonal recommendation. A half dose of N and full dose of P were applied at the time of sowing, in the form of urea and DAP. The remaining half dose of the N was top dressed in the form of urea in two splits at the time of first and second irrigation. During 2009-10, a foliar spray of 1% soluble NPK (19:19:19) at flowering stage was also applied to the crop for harvesting the higher yield. Total 5 flood irrigations, each of about 6 cm depth were applied as per requirement of the crop. Two hand weeding were also carried out at 30 and 45 days after sowing to have the crop free from weeds. Data recorded on seed yield for 2 years was analysed using standard analysis of variance (ANOVA) technique through Excel software of Microsoft Office.

During 2008-09, an experiment on integrated nutrient management was also carried out at 4 farmer's fields for validation and dissemination of improved nutrient management technology. The experiment was laid out uniformly in strips of 0.40 ha accommodating each treatment in 0.10 ha land at each location. Improved seed and fertilizers were provided to famers as experimental input.

During 2011-12, a technology demonstration of improved seed (var. RI-1) and foliar spray of 1% soluble NPK (19:19:19) at flowering stage was also laid out at 50 farmer's fields (Jalore 24, Pali 13, Sirohi 3 and Jodhpur 10 farmers). The technology demonstration was laid out in strips of 0.40 ha at each location. Improved seed and soluble NPK were provided to famers under technology demonstration.

Field day programmes were also organised at demonstration sites to witness the performance of technology package vs. farmer's practice.

Results and Discussion

Varietal performance

Differences among varieties for seed yield were found statistically significant during both years. First year, seed yield ranged between 9.13 to 11.73 q/ha with the mean of 10.52 q/ha; however, in second year, it ranged between 12.75 to 18.05 q/ha with the mean of 15.16 q/ha. On the basis of two years performance, maximum yield of 14.31 q/ha was recorded in variety RI 89 followed by RI 3025 and GI 2 with 14.10 and 13.67 q/ha, respectively (Table 1). Therefore, varieties RI-89 and GI-2 may be promoted for cultivation in Transitional Plain of Luni Basin of Rajasthan for enhancing the production and productivity of isabgol. Improved genotype of isabgol RI-3025 may be further evaluated under multi location trials of crop improvement.

Table 1. Seed yield of different varieties of isabgol

S. No.	Varieties		Seed yield (q/ha)	
		2007-08	2008-09	Mean
1.	RI-3025*	10.15	18.05	14.10
2.	RI-3026*	10.97	13.25	12.11
3.	RI-3004*	9.13	12.75	10.94
4.	RI-1	10.33	13.88	12.11
5.	GI-2	10.60	16.73	13.67
6.	HI-2	10.33	14.63	12.48
7.	RI-89	11.73	16.88	14.31
	Mean	10.52	15.16	12.84
	SEm±	0.41	0.83	-
	CD (p=0.05)	1.28	2.56	-
	CV (%)	6.82	10.95	-

*Improved genotypes

Effect of integrated nutrient management practices on seed yield of isabgol

Results reveled that the use of FYM @ 10 t/ha along with recommended dose of fertilizers (30kg N + 25 kg P_2O_5) provided 28.75% increase in seed yield of isabgol over farmer's practice. The application of biofertilizers (PSB & Azotobactor) has further accelerated the productivity level (Table 2). Therefore, the use of FYM @ 10 t/ha and biofertilizers (PSB & Azotobactor) should be encouraged along with chemical fertilizers @ 30kg N + 25 kg P_2O_5/ha for harvesting the higher seed yield of isabgol

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Effect of improved seed and foliar nutrition of soluble NPK on seed yield of isabgol

Results of technology demonstrations revealed that improved treated seed (var. RI 1) and foliar spray of 1% soluble NPK at flowering stage provided 27.35% increase in seed yield of isabgol over farmer's practice (Table 3). The foliar nutrition of soluble NPK might have played an important role in photosynthesis, growth regulation along with tolerance against environmental stresses. The foliar nutrition of 1% soluble NPK needs to be promoted at farmer's field for enhancing the production and productivity of isabgol.

Table 3. Seed yield of isabgol as affected by improved seed and foliar nutrition at farmers fields

S. No	Particulars	Average seed yield (q/ha)	Yield increase over farmers practice
1.	Technology package Improved treated seed @ 5 kg/ha Foliar spray of 1% soluble NPK at flowering stage	7.45	27.35%
2.	Farmers own seed & management practice	5.85	-

Isabgol variety RI 89 has been found most suitable for cultivation in Transitional Plain of Luni Basin of Rajasthan. It was followed by improved genotype RI 3025 and variety GI 2. The application of FYM @ 10 t/ha and biofertilizers (PSB & Azotobactor) along with chemical fertilizers @ 30kg N + 25 kg P_2O_5/ha is beneficial in harvesting the higher seed yield. The use of improved seed with recommended seed rate of 5 kg/ha along with foliar spray of 1% soluble NPK at flowering stage should also be promoted at farmer's field for enhancing the production and productivity of isabgol.

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