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Short Communication

Evaluation of INM and IPM Practices for Enhancing Moth Bean Productivity in Transitional Plain of Luni Basin of Rajasthan

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Moth bean [*Vigna aconitifolia* (Jacq.) Marchel] is a short duration, deep rooted legume recognized for its twin benefits of tolerance to drought and heat. Moth bean is a potential reservoir of proteins (22-26%) and essential minerals like Ca, Fe, Mn and Zn. It is grown in 12.6 lakh ha, which is more than 50% of total area under *kharif* pulses grown in Rajasthan. The production and productivity of moth bean is highly erratic and varies with the amount and distribution of rainfall as well as pest and diseases infestation. A large number of research experiments have shown that moth bean productivity may be enhanced considerably through improved seed, crop management practices and plant protection measures but their adoption at farmers' fields seem to be very poor because of weak research-extension linkage. Therefore, three different field experiments were conducted on selection of suitable varieties and validation of integrated nutrient management and pest management at farmers' fields for augmenting moth bean production.

Three different experiments on selection of high yielding varieties, integrated nutrient management (INM) and integrated pest management (IPM) were conducted in Transitional Plain of Luni Basin (Zone IIb) of Rajasthan, which covers whole area of Jalore and Pali districts, and a part of Jodhpur and Sirohi districts. The performance of five released and notified varieties (Table 1) was tested for two years at Agricultural Research Station, Keshwana, Jalore on clay loam soil. The experimental site is situated at latitude of 25°22'N and longitude of 72° 58'E, elevation of 162 m above msl and has a tropical arid climate with mean annual rainfall of 421 mm. The experiment was laid out in a randomized block design with 4 replications accommodating 4 m long 8 rows per plot at 30 cm row distance with seed rate of 12 kg/ha. A fertilizer dose of 10:20 kg/ha of nitrogen and phosphorus, respectively were applied at the time of sowing. Foliar spray of 1% soluble NPK (19:19:19) at flowering stage was also done to achieve higher productivity. Sowing was done on July 8th and 20th in 2009 and 2012, respectively. The experiment was conducted as rainfed but under moisture stress situation, life saving irrigation was also given to the crop. Two hand weedings were carried out at 20 and 40 days after sowing.

In another study, INM and IPM practices were validated at famers' fields in different parts of zone IIb. One experiment on INM with four treatment combinations (Table 2) was conducted on 20 farmers' fields during *kharif* 2011. Another experiment on IPM with 3 treatment combinations (Table 3) was also conducted on 15 farmers' fields in the same year. Experiments were laid out uniformly in strips of 0.40 ha. Variety RMO-435 was used for the study. All experimental inputs including seed, fertilizers and pesticides as per treatments were provided to farmers.

Performance of varieties

Differences among moth bean varieties for seed yield were statistically significant in first year only. During 2009, average productivity of moth bean was 14.2 q/ha with the range of 12.4 and 15.7 q/ha; however, during 2012, it ranged between 7.07 and 8.17 q/ha with the average of 7.75 q/ha. On the basis of two years data, maximum seed yield of 11.94 q/ha was recorded in variety RMO-257, which was followed by RMO-435 and RMO-40 with 11.29 and 11.02 q/ha, respectively. Biological yield of moth bean also followed the same trend and yield levels varied considerably during both growing seasons. The maximum biological yield was found in RMO-435 followed by RMO-257. Maximum test weight and number of pods/plant were recorded in RMO-435 followed by RMO-257 (Table 1). Differences among varieties for observations recorded on days to 50 percent flowering, number of seeds/pod and pod length were non-significant and not found suitable for selection of high yielding varieties in moth bean. Yogeesh *et al*. (2012) evaluated 121 moth bean genotypes and reported the range for days to 50% flowering 33-52, number of seeds/pod 4.3-7.0, 1000 seed weight 18-49 g, number of pods/plant 26.75-203.50, and seed protein content 18.54-26.62%.

Table 1 : Yield and yield attributes of different varieties of moth bean

Variety	Seed yield (q/ha)			Biological yield (q/ha)			1000 seed wt. (g)	No. of pods/ plant	No. of seeds/ pod	Pod length (cm)
	2009	2012	Mean	2009	2012	Mean				
RMO-40	14.30	7.73	11.02	36.00	24.00	30.00	32.60	44.49	6.05	3.83
RMO-225	12.40	7.93	10.17	36.10	22.00	29.05	32.42	41.01	5.85	3.83
RMO-257	15.70	8.17	11.94	41.90	23.00	32.45	35.37	47.11	6.16	4.13
RMO-423	13.10	7.87	10.49	38.20	23.67	30.94	34.24	43.78	5.96	3.83
RMO-435	15.50	7.07	11.29	48.90	23.33	36.12	38.49	46.40	5.99	3.97
CD (P=0.05)	1.30	NS	-	3.10	NS	-	-	-	-	-

Integrated nutrient management

All three treatment combinations (Table 2) provided higher seed yield over farmers' practice, which indicate that the adoption of fertilizers application in moth bean by farmers' is very poor. Seed treatment with *Azotobactor* and PSB along with basal application of P (7.5 kg/ha) and N (15 kg/ha) followed by foliar spray of 1% soluble NPK (19:19:19) at flowering stage provided maximum seed yield of 5.92 q/ha, which was 27.4% higher over farmers' practice followed by the use of 125% recommended dose of fertilizers (RDF) and 100% RDF along with bio-fertilizers, respectively (Table 2). Aruna Kumar and Uppar (2006) reported that additional application of FYM 10 t/ha along with RDF (N 10 kg/ha & P 20 kg/ha) significantly enhanced seed yield of moth bean over farmers' practice.

Table 2 : Seed yield of moth bean as affected by nutrient management on farmers' fields

Treatment	Seed yield (q/ha)	% Increase over FP
125% RDF	5.36	19.8
100% RDF (10 kg N & 20 kg P/ ha) + bio-fertilizer (*Azotobactor* + PSB)	5.19	17.2
75% RDF + bio-fertilizer (*Azotobactor* + PSB) + 1% foliar spray of soluble NPK (19:19:19) at flowering stage	5.92	27.4
Farmers' practice (FP)	4.30	-

RDF: Recommended dose of fertilizers; PSB: Phosphorus solublizing bacteria

Integrated pest management

Pests and disease management plays a significant role in enhancing the productivity of moth bean but their adoption at farmers' fields is very poor. IPM module including seed treatment with carbandazim @ 2 g/kg and bio-fertilizers (*Rhizobium* + PSB) + foliar spray of azadirachtin @ 0.03% and thiomethoxam 25 WG @ 100 g/ha at 30 and 45 days after sowing, respectively provided 40.2% higher seed yield over farmers' practice. Organic module which included seed treatment with *Trichoderma* @ 8 g/kg along with bio-fertilizers (*Rhizobium* + PSB) and foliar spray of azadirachtin @ 0.03% at 30 and 45 days after sowing provided 23.6% yield enhancement (Table 3). Therefore, both IPM and organic modules were effective against pests and diseases of moth bean but efficacy of IPM module was higher than the organic module.

Table 3 : Seed yield of moth bean as affected by different pest management modules

Treatment	Seed yield (q/ha)	% Increase over FP
Organic module: Seed treatment with *Trichoderma* @ 8 g/kg + foliar spray of azadirachtin @ 0.03% at 30 and 45 days after sowing	7.76	23.6
IPM module: Seed treatment with carbandazim + foliar spray of azadirachtin @ 0.03% at 30 days and thiomethoxam 25 WG @ 100 g/ha at 45 days after sowing	9.92	40.2
Control: Farmers' practice	5.93	-

IPM: Integrated pest management

The most promising and appropriate varieties RMO-257 and RMO-435 may be cultivated along with seed treatment with *Azotobactor* and PSB, basal application of phosphorus (7.50 kg/ha) and nitrogen (15 kg/ha) followed by foliar spray of 1% soluble NPK (19:19:19) at flowering stage for realizing higher yield. Plant protection measures including seed treatment with carbandazim @ 2g/kg and foliar spray of azadirachtin @ 0.03% and thiomethoxam 25 WG @ 100 g/ha at 30 and 45 days after sowing, respectively may be followed for pests and disease management.

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