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Validation of Significant Varieties and Crop Management Practices of Mustard (*Brassica juncea*) at Farmer Fields in Transitional Plain of Luni Basin of Rajasthan

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Abstract: A study was carried out to validate the varieties and crop management practices of mustard at farmer's fields in Transitional Plain of Luni Basin of Rajasthan. Varieties Urvashi, RRN-505, GM-2 and JM-1 provided higher grain yield than average. Seed soaking in 500 ppm thiourea for 4 hrs before sowing and foliar spray of 1000 ppm thiourea at flowering and grain filling stages enhanced mustard yield by 18.93% and 21.71%, respectively; however, foliar spray of 100 ppm salicylic acid provided 12.88% yield enhancement. Application of recommended dose of fertilizers 60 kg N and 40 kg P per hectare provided 22.95% higher yield over farmer's practice. Foliar fertilization of 1.0% soluble NPK at flowering stage also enhanced mustard grain yield. Soil application of gypsum @ 250 kg ha^{-1} enhanced mustard yield by 21.51% under irrigated problematic soil and water situations.

Key words: Bio-regulator, grain yield, gypsum, mustard, nutrient management, varieties.

Mustard (*Brassica juncea)* is an important oilseed crop for the state of Rajasthan. It is cultivated under irrigated as well as conserved moisture conditions. The area of mustard under conserved moisture depends up on the amount and distribution of rainfall during preceding season. In Rajasthan, mustard has occupied an area of 25,21,292 hectare (average of 2008-09 to 2012-13) with annual production of 33,94,386 tonnes. It is grown in all parts of Rajasthan but major area has been covered by district Alwar, Bharatpur, Sriganganagar, Sawai Madhopur, Jaipur and Hanumangarh. The average productivity of mustard in Rajasthan ranged between 614 kg in district Jaisalmer and 1695 kg ha^{-1} in district Bharatpur with the state average of 1346 kg ha^{-1} (Anonymous, 2013-14).

A large number of research experiments have shown that crop productivity may be enhanced considerably through improved varieties and crop management practices but their adoption at farmer's fields is poor because of weak research-extension linkage. Farmer participatory action research is a sound research oriented extension programme, where farmers have an option to choose best variety and crop management technology for their own field situation (Sharma, 2014). Present studies were conducted with the objectives of validation and transfer of technology at farmer's fields in Transitional Plain of Luni Basin (Zone IIb) of Rajasthan.

Materials and Methods

Four separate experiments on mustard were conducted at farmer's fields in Transitional Plain of Luni Basin (Zone IIb) of Rajasthan (districts Jalore, Pali and Jodhpur) during rabi 2009-10. In first experiment, seven released and notified varieties of mustard were evaluated at seven locations in different parts of zone-IIb. In second experiment, four treatment combinations of nutrient management practices were tested at 8 locations. In third experiment, effect of seed soaking and foliar spray of bio-regulators on mustard grain yield was estimated at 6 locations. However, in fourth experiment, effect of soil application of gypsum on grain yield of mustard under problematic soil and water situation was tested at 11 locations. Variety Urvashi was used for experimentation. All experiments were laid out in strips in 0.40 ha. A fertilizer dose of 60 kg nitrogen and 40 kg phosphorus per hectare were applied as per the recommendation of zonal package of practices. A half dose of N and full dose of P was applied at the time of sowing in the form of urea and single super phosphate (SSP). The remaining half of the N was top dressed in the form of urea with first irrigation.

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Results and Discussion

Performance of varieties

The grain yield of mustard varieties ranged between 12.6 to 14.8 q with the overall average of 13.8 q ha^{-1}. The maximum grain yield was provided by variety Urvashi followed by RRN-505, GM-2 and JM-1 with 14.4, 14.3 and 14.1 q ha^{-1}, respectively (Table 1). The yield levels of these varieties were higher than average. Therefore, these varieties may be promoted for cultivation to harness the higher yield of mustard in Transitional Plain of Luni Basin of Rajasthan.

Table 1. Grain yield of mustard varieties at farmer fields

Varieties	Seed yield (q ha^{-1})
RH-30	12.6
Bio-902	13.7
GM-2	14.3
Urvashi	14.8
JM-1	14.1
RRN-505	14.4
CS-52	12.6
Average	13.8

Effect of seed soaking and foliar spray of bio-regulators on grain yield

Results revealed that seed soaking and foliar spray of thiourea enhanced grain yield of mustard by 18.9% and 21.7%, respectively over farmer's practice (Table 2). However, foliar spray of salicylic acid 100 ppm at flowering and grain filling stage provided the yield enhancement of 12.88%. Therefore, seed soaking in thiourea 500 ppm for 4 hrs followed by foliar spray of thiourea 1000 ppm at flowering and grain filling stages may be promoted in mustard for harnessing the higher grain yield.

It was experienced that under high salinity conditions, uniform crop stand and crop establishment is difficult but once crop is established, it can be grown even under high salinity also. Seed soaking in thiourea may be helpful in seed germination and giving better establishment and uniform crop stand. Therefore, seed soaking of thiourea may be promoted in general and problematic soil conditions in particular. However, further testing and validation of technology under different salinity levels is required.

Effect of nutrient management on grain yield

The application of recommended dose of fertilizers (RDF) provided maximum grain yield, which was 22.9% higher over farmer's practice (Table 3). The grain yield of mustard was found to be reduced with the reduction in fertilizer application. However, application of 50% recommended dose of fertilizers along with biofertilizers + foliar spray of 1.0% soluble NPK at flowering stage provided better results than the application of 75% recommended dose of fertilizers along with biofertilizer. It appears from the study that there is a big scope of yield enhancement in mustard through nutrient management at farmer's fields. Foliar fertilization of 1% soluble NPK at flowering stage has a wide scope for yield enhancement of mustard. Subhash Chand (2007) reported that application of 45 kg N, 30 kg P, 15 K and 30 kg S along with bio-fertilizers provided 23% higher grain yield in mustard over control.

Effect of soil application of gypsum on grain yield

Results revealed that soil application of gypsum is beneficial to mustard under problematic soil and water situation and enhanced grain yield by 21.5% with the soil application of gypsum @ 250 kg ha^{-1}. Being easily available and cheapest source of calcium and sulphur, gypsum is commonly used to reclaim saline sodic soils as well as an essential nutrient for oilseed crops. Therefore, the

Table 2. Grain yield of mustard as affected by seed soaking and foliar spray of bio-regulators

Treatments	Average grain yield (q ha^{-1})	Yield increase over farmer's practice
Seed soaking in thiourea 500 ppm for 4 hrs before sowing	12.0	18.9%
Foliar spray of thiourea 1000 ppm at flowering and grain filling stage	12.3	21.7%
Foliar spray of salicylic acid 100 ppm at flowering and grain filling stage	11.4	12.9%
Farmers practice (FP)	10.1	-
Average	11.4	-

Table 3. Grain yield of mustard as affected by nutrient application

Treatments	Grain yield (q ha^{-1})	Yield increase over farmer practice
100% RDF (60 kg N + 40 kg P_2O_5 ha^{-1})	10.8	22.9%
75% RDF+ biofertilizers	9.6	9.4%
50% RDF + biofertilizers + foliar spray of 1.0% soluble NPK	9.9	12.3%
Farmers practice	8.8	-
Average	9.8	-

Table 4. Grain yield of mustard as affected by gypsum application

Treatments	Grain yield (q ha^{-1})	Yield increase over farmer's practice
Soil application of gypsum @ 250 kg ha^{-1}	12.4	21.5%
Soil application of gypsum @ 150 kg ha^{-1}	11.4	11.7%
Farmers practice (FP)	10.2	-
Average	11.4	-

application of gypsum @ 250 kg ha^{-1} may be promoted in mustard for yield enhancement in general and irrigated problematic soil and water in particular. Seed germination, mortality of young seedlings and poor tillering of crop plants are serious problems of saline sodic soils. Sadiq *et al*. (2002) reported that soil application of gypsum decreases soil pH, EC and SAR and improved soil physical health as well as the crop growth. They found significant improvement in germination, plant growth, test weight and grain yield of mustard with the soil application of gypsum. Akbari *et al* (2003) reported 17.9% yield enhancement of mustard due to soil application of gypsum @ 4.0 t ha^{-1}.

Conclusion

The use of high yielding varieties like Urvashi, JM-1, RRN-505 and GM-2 along with recommended dose of fertilizers and soil application of gypsum @ 250 kg ha^{-1} should be promoted for mustard cultivation in Transitional Plain of Luni Basin of Rajasthan. Seed soaking in 500 ppm thiourea for 4 hrs before sowing and foliar spray of 1000 ppm thiourea or 1% soluble NPK at flowering and grain filling stages also enhance the mustard productivity.

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