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Influence of Foliar Application of Pulse Magic on Seed Yield and Economics of Pigeonpea Grown under North Eastern Dry Zone of Karnataka

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Authors' contributions

This work was carried out in collaboration between all authors. Authors JRP and RGT involved in designing the demonstration successfully and wrote the draft of the manuscript. Author VT involved in collecting data, writing the manuscript and supervision of work. All authors read and approved the final manuscript.

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ABSTRACT

Pigeonpea is extensively grown in northeastern dry zone of Karnataka and it occupies a unique position in every cropping system of this zone. Crop Productivity of pigeonpea being low in the north-eastern dry zone of Karnataka and this is due to several reasons. One of the main important and major reason is flower drop and poor drop setting. To reduce this problem and to enhance productivity of pigeonpea Krishi Vigyan Kendra (KVK), Kalaburagi, Karnataka has carried out 100 Front Line Demonstrations (FLD) in Jewargi taluka of kalaburagi district with use of Pulse Magic (consists of nutrients and Plant growth regulators) as foliar spray during *kharif* 2017-18 in rainfed condition in the farmers field under National Food Security Mission (NFSM) and the majority of farmers were growing TS3-R variety. Foliar spray was carried out during 50% flowering stage and 15 days after 1st Spray. The result indicated due to foliar spray of Pulse Magic were: higher number of pods per plant (278), seeds per pod (4.3) and test weight (11.5 g), compared to control (191, 3.5

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and 10.7 g, respectively). Due to increase in yield attributes higher seed yield was obtained (14.2 q/ha), as compared to control (11.6 q/ha). Consequent upon higher yield, higher net returns (Rs. 53800 /ha) were obtained in Pulse Magic spayed plots compared to unsprayed plots (Rs. 42600/ha).

Keywords: Economics; front line demonstrations; pigeonpea; yield attributes and yield.

1. INTRODUCTION

Food legumes contribute significantly to dietary protein supply and fixation of atmospheric nitrogen [1]. Pulses are important food crops due to their high protein and essential amino acid content. The seeds of pulse crops are typically made up of 20-25 per cent protein compared to 6-10% protein content in major cereal crops. Pulses are the main source of protein in the diet of vegetarians. Moreover, in recent years there has been a change in the consumption of pulses in several developed countries where they are increasingly considered as healthy foods [2]. Thus, the food legumes ensure nutritional security to the poor masses of the country [3], these are also helps in solubilising insoluble phosphorous in soil, improving the soil physical environment, increasing soil microbial activity and restoring organic matter and also have smothering effect on weeds [4]. Legumes have certain phytochemicals like polyphenols, flavonoids and phytosterols that possess health benefits [5].

Among grain legumes, pigeonpea (*Cajanus cajan* L.) is grown extensively in North Eastern Dry Zone Of Karnataka. It can be grown in wide range of soils, from sandy to heavy soils. It is able to tolerate drought conditions during dry seasons but not light frost during any stage of its growth. It appears to be better adapted to marginal climatic conditions than any other pulse crops [6]. Pigeonpea is a multipurpose crop, used for fodder, soil fertility enhancement, soil erosion control and for fuel. Deeper root system of the crop also helps in breaking the plough pans and improving soil structure and hence it is called as crop of “Biological plough”.

In India, major pigeonpea growing state includes Maharashtra, Uttar Pradesh, Madhya Pradesh, Karnataka, Gujarat, Telangana and Tamil Nadu. Pigeonpea occupies an area about 3.96 million hectare producing 2.56 million tonnes with an average productivity of 646 kg per hectare in India [7]. Whereas, in Karnataka, it is cultivated over an area of 6.57 lakh ha. with a production of 2.42 lakh tonnes and having the average productivity of 368 kg per hectare [7].

Yield of pigeonpea is declining and it is due to several reasons and one of the important reason for low yield of pigeonpea is due to high level of flower abscission (70-96%), leading to a much-reduced realization of sink potential [8,9]. Therefore, it is realized that low yield in pigeonpea is due to excessive vegetative growth, indeterminate growth habit, poor source-sink relationship, poor pod set resulting from the high flower and pod drops. So, it is very necessary to compensate for the high degree of flower abscission in pigeonpea to increase the pod yield.

Among several strategies to boost the productivity of pigeonpea, foliar application of nutrients may serve as one of the important strategy. Nutrients play vital role in increasing the seed yield in pulses [10]. Foliar application is credited with the advantage of quick and efficient utilization of nutrients, elimination of losses through leaching and fixation and regulating the uptake of nutrients by plants [11,12]. Application of nutrients through foliar spray at appropriate stages of growth becomes important for their utilization and better performance of the crop [13]. Keeping this in view, front line demonstrations of pigeonpea under National Food Security Mission (NFSM) to reduce flower drop and to enhance pod setting with the use of Pulse Magic spray is conducted to demonstrate the productivity potential and economic benefit under farmer’s conditions.

2. MATERIALS AND METHODS

Participatory Rural Appraisal (PRA) method and focused group discussions with identified progressive farmers were held by the team of scientists to identify the various problems faced by farmers in getting a potential yield of important pulse crops. The problem noticed are about use of local varieties, nutrient supply, flower drop and pod setting at the field level apart from pest and diseases. 100 Front Line Demonstration on usage of Pulse Magic were conducted at farmer’s fields of Jewargi taluka in kalaburagi district during *Kharif* 2017-18 under National Food Security Mission (NFSM) and the majority

of farmers were growing TS3-R variety. There were two treatments *viz.,* recommended a dose of nitrogen and phosphorous (25:50 kg/ha) with Pulse Magic spray and another with an Only recommended dose of nitrogen and phosphorous (25:50 kg/ha) and no use of Pulse Magic (unsprayed plots). The Pulse Magic contains 10% of nitrogen, 40% of phosphorus, 3% of micronutrients and 20 ppm PGR. 10 g of the nutrient mixture and 0.5 ml of plant growth regulator (PGR) mixed in one-liter water sprayed two times, first spray during 50% flowering stage and second spray during 15 days after first spray. Pulse Magic was developed in the year 2014 from University of Agricultural Sciences, Raichur, Karnataka to reduce flower drop and to enhance productivity in major pulse crops. Each demonstration was conducted in an area of 0.4 hectare adjacent to the plots of check. Data on yield and yield attributes were collected from randomly selected five plants, the economics of pigeonpea cultivation were collected from majority of beneficiaries (farmers) and average data are tabulated. Further, the cost of cultivation was higher in demonstration plot because of adaptation of technology and cost of pigeonpea grain is Rs.5500/- per quintal for calculating gross and net returns.

3. RESULTS AND DISCUSSION

It has been well established that seed yield finally depends on yield attributing characters**.** In the present demonstration, higher yield attributing characters *viz.,* number of pods per plant (278) and number of seeds per pod (4.3) were obtained in Pulse Magic sprayed plots compared to unsprayed plots (191 and 3.5, respectively) and it is may be attributed due to the application of nutrients and PGR at flowering and pod formation stage has helped in more translocation of photosynthates to the developing pods which in turn helped in better filing of grains, thus increasing the test weight (11.5 g) of the seeds compared to unsprayed plots (10.7 g). Our results of demonstration are similar to the findings of Thakur et al. [14] due to foliar application of Pulse Magic in blackgram.

Direct positive effect of 100 seed weight (test weight) on seed yield was reported by Chandirakala and Raveendran [15]. In the present demonstration, higher test weight was obtained in Pulse Magic spayed plots, which further increased the final seed yield to the extent of 21% compared to unsprayed plots (Table 1). Similarly, foliage applied macro and micronutrients at critical stages of the crop were effectively absorbed and translocated to the developing pods, producing more number of pods and better filling in soybean was reported by Jayabel et al. [16].

One of the main reason for increasing seed yield to the extent of 21% compared to unsprayed plots is reduction of flower and pod drop, as it is well known that in pigeonpea around 70-96% flowers are abscised [8,9] leading to poor yield and controlling that can help in achieving potential yield. Similar results of reduction in flower drop due to foliar application of Pulse Magic have been reported by Teggelli et al. [17] in pigeon pea. The Results of present demonstration are in agreement with the findings of Marimuthu and Surendran [18] in blackgram due to application of 100 percent recommended dose of nitrogen, phosphorous

Table 1. Effect of foliar application of pulse magic on yield attributes and Yield of Pigeonpea

Year	No of demonstrations	Area (ha)	No of pods/plant		No of seeds/ pod		100 seed weight (g)		Seed yield (q / ha)		% increase yield over check
2017-18	100	0.4	T_1	T_2	T_1	T_2	T_1	T_2	T_1	T_2	21
			278	191	4.3	3.5	11.5	10.7	14.2	11.6	

Table 2. Effect of foliar application of pulse magic on economics of Pigeonpea

Year	No of demonstrations	Area (ha)	Cost of cultivation (Rs./ha)		Gross return (Rs./ha)		Net return (Rs./ha)		B:C ratio	
2017-18		0.4	T_1	T_2	T_1	T_2	T_1	T_2	T_1	T_2
	100		24300	21200	78100	63800	53800	42600	3.21	3.00

T1: Recommended dose of fertilizers with Pulse Magic spray
T2: Recommended dose of fertilizers only and no Pulse Magic spray

and potassium + foliar application of diammonium phosphate @ 2 per cent + TNAU pulse wonder at 5.0 kg per hectare at 45 days after sowing resulted in higher number of pods per plant and grain yield. Further, due to increment in seed yield in Pulse Magic sprayed plot there was higher gross returns (Rs 78100/ha) and net returns (Rs. 53800/ha) compared to control (Rs. 63800/ha and Rs.42600/ha, respectively) (Table 2).

4. CONCLUSION

It has been well-established fact that in pigeonpea as much as around 70-96% of flowers are shed or abscised, leading to poor yield. If this major problem is minimised then there will be the attainment of the productive potential of the crop and ultimately there will be sustainability achievement. This major problem can be minimised by foliar application of Pulse Magic during 50% flowering stage and 15 days after first spray. The results obtained due to foliar application of Pulse Magic were: higher yield attributes and due to higher yield attributes there was an increment in yield to the extent of 21% in Pulse Magic sprayed plots as compared to unsprayed plots. Consequent upon higher yield, higher income was obtained in Pulse Magic sprayed plots compared to unsprayed plots (check).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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