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Field evaluation of propiconazole fungicide against gray mold disease of castor

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Abstract

Castor (*Ricinus communis* L.), is an important non-edible oilseed crop which belongs to the family Euphorbiaceae which plays a vital role in Indian vegetable oil economy. Gray mold of castor is one of the major destructive fungal disease causing huge yield loss. The occurrence of gray mold is strongly governed by weather conditions. In on farm demonstrations on fungicidal management of gray mold conducted during *kharif* 2019 at different locations in Mahabubnagar dt. and IOR farm fields. Prophylactic sprays of propiconazole fungicide 0.1% was given based on the alerts given by the decision support system (DSS) for gray mold developed by ICAR- IOR based on weather data obtained from Wireless Sensors Networks (WSN) deployed in farmer's fields and observation on disease severity and seed yield were recorded manually in IOR farms and farmer fields of Mahabubnagar district of Telangana state. The results revealed that two sprays of propiconazole @0.1% has recorded least percent disease severity and significantly increased the seed yield.

Keywords: Castor, gray mold, management, propiconazole

Introduction

Castor is one of the important commercial non-edible oilseed crops of India earning more than 4500 crores every year to the national exchequer. India is the leading producer of castor in the world (FAOSTAT, 2019) [4] with an annual production of about 1.19 Mt. India accounts for nearly 73% of the world's production of castor (FAOSTAT, 2019) [4]. In India, castor is cultivated in an area of 7.6 lakh ha with 11.29 lakh tons of production and the average yield is 1520 Kg ha⁻¹ for the year 2018-2019 (SEA, 2019) [10]. Gujarat, Rajasthan and Andhra Pradesh are the major castor producing states of India. Andhra Pradesh accounts for 40 per cent of the total cultivated area. The important castor growing districts in Andhra Pradesh and Telangana states include Mahabubnagar, Kurnool, Ananthapur, Nalgonda and Prakasam. Gray mold caused by *Botryotinia ricini* is one of the very important diseases of castor inflicting huge yield losses to farmers in Telangana st. (Prasad *et al.*, 2016) [9] when there is heavy and continuous rains during spike/ capsule formation stage. The prevalence of high relative humidity and prolonged wet conditions during flowering stage are congenial for pathogen development (Soares, 2012) [13]. At present, the management practices for this disease include application of fungicides like carbendazim before and after cessation of rains based on weather forecasting (Sudhakar *et al.* 2010; Prasad *et al.* 2016) [14, 9]. But there is still a need to identify better fungicides for the management of *B. ricini* infection on castor under Telangana conditions. Use of chemical fungicides have shown efficacy of propiconazole against gray mold under experimental field conditions (Anonymous, 2018) [1]. Large scale on farm demonstrations have been taken up under farmers' fields in Mahabubnagar dt. And IOR farms to showcase potential of the fungicide propiconazole in management of gray mold disease.

Materials and Methods

On farm demonstration of management of gray mold of castor using chemical fungicide has been taken up in farmer's field in narva manal of mahabubnagar district of Telangana state and IOR farm fields during *kharif* 2019. In this experiment cv. DCH-519 were sown at the narva manal farmers field and research farms of ICAR-IIOR, Hyderabad in rows 0.9 m apart and 0.6 m between plants within the rows. Fungicides was used at their respective doses in the field conditions.

The treatment (Fungicide) at the respective doses before application was mixed thoroughly with water and applied through power sprayer on racemes of castor as foliar sprays. Prophylactic sprays of propiconazole fungicide 0.1% was given based on the alerts given by the decision support system (DSS) for gray mold developed by ICAR-IIOR based on weather data obtained from Wireless Sensors Networks (WSN) deployed in IOR farms and farmer fields of Mahabubnagar district of Telangana state. Later, the same fungicide was sprayed when the disease was initiated in the fields. However control was kept without any treatment only water was sprayed.

Data recorded: During the cropping season, observation on disease severity (%) and seed yield (kg/ac) were recorded at regular interval in IOR farms and farmer fields of Mahabubnagar district of Telangana state.

Economics: Cost of cultivation (₹/ac) was calculated considering the prevailing charges of plant protection operations and market price of inputs involved. Gross returns were obtained by converting the harvest into monetary terms at the prevailing market rate during the course of study.

Gross return (Rs/ac) = (Seed yield x price)

Net returns were obtained by deducting cost of cultivation from gross return Net returns (Rs /ac) = Gross return (Rs /ac) - Plant protection cost (Rs /ac)

The benefit: cost ratio was calculated by dividing Net returns by Plant protection cost

$$\text{Benefit: Cost ratio} = \frac{\text{Net returns (Rs /ac)}}{\text{Plant protection cost (Rs/ac)}}$$

Results and Discussion

During *khariif* 2019, Farmer's field in Mahabubnagar district of Telangana state gray mold severity in castor ranged from 24.1 to 26.5% and a seed yield recorded was between 515 and 580 kg/acre in fields where one spray of Propiconazole fungicide (0.1%) was taken up. In fields where fungicide was sprayed twice, a disease severity of 9.0 and 11.7% was recorded with 746 and 819 kg/acre seed yield was found most effective and proved to be most economical with higher benefit-cost ratio of 1:4.4 and 1:5.0 respectively. Disease severity ranging from 74.0 to 80.3% and seed yield between 186 and 215 kg/acre was recorded in unsprayed fields (Table 1). In ICAR-IIOR farm fields, where Propiconazole fungicide (0.1%) was sprayed once a disease severity of 23.3% was recorded with 560 kg/acre seed yield. In fields where fungicide was sprayed twice a disease severity of 9.2% was recorded with 812 kg/acre seed yield was found most effective and proved to be most economical with higher benefit-cost ratio of 1:4.9. Disease severity 72.2% and seed yield 202kg/acre was recorded in unsprayed fields (Table 2). This significant difference indicates the efficacy and importance of timely spray of Propiconazole can reduce the disease severity and thereby increase the seed yield of the castor.

Table 1: On farm demonstration of efficacy of propiconazole fungicide on gray mold of castor (Narvamandal, Mahabubnagar, Telangana)

Location	Treatment	Disease severity (%)	Seed yield (kg/acre)	Increase in yield over control (kg/ac)	Increase in yield over control (%)	Cost of increased yield (Rs.) (A)	Plant protection cost* (Rs.) (B)	Net profit (Rs.) A-B	ICBR
Jaklair	Propiconazole 1ml/l(One prophylactic spray based on weather forecast)	24.1	580	365	41.0	16,060	4500	11,560	1:2.6
	Propiconazole 1ml/l(Two sprays based on weather forecast)	10.3	805	590	63.5	25,960	4500	21,460	1:4.8
	Control(No sprays)	74.0	215	-	-	-	-	-	-
Undyala	Propiconazole 1ml/l(One prophylactic spray based on weather forecast)	25.4	540	354	47.4	15,576	4500	11,076	1:2.4
	Propiconazole 1ml/l(Two sprays based on weather forecast)	11.7	746	560	66.8	24,640	4500	20,140	1:4.4
	Control(No sprays)	80.3	186	-	-	-	-	-	-
Kanimetta	Propiconazole 1ml/l(One prophylactic spray based on weather forecast)	26.5	515	313	35.4	13,772	4500	9,272	1:2.1
	Propiconazole 1ml/l(Two sprays based on weather forecast)	9.0	819	617	67.2	27,148	4500	22,648	1:5.0
	Control(No sprays)	75.6	202	-	-	-	-	-	-

*Market price of castor: Rs.44/kg; Fungicide spray cost including /acre; 4500 included; ICBR = Net profit/Plant protection cost

Table 2: On farm demonstration of efficacy of propiconazole fungicide on gray mold of castor (IIOR, Hyderabad)

Location	Treatment	Disease severity (%)	Seed yield (kg/acre)	Increase in yield over control (kg/ac)	Increase in yield over control (%)	Cost of increased yield (Rs.) (A)	Plant protection cost* (Rs.) (B)	Net profit (Rs.) A-B	ICBR
IIOR research farm	Propiconazole 1ml/l(One prophylactic spray based on weather forecast)	23.3	560	355	42.2	15,620	4500	11,120	1:4.7
	Propiconazole 1ml/l(Two sprays based on weather forecast)	9.2	812	607	66.2	26,708	4500	22,208	1:4.9
	Control (No sprays)	72.2	205	-	-	-	-	-	-

*Market price of castor: Rs.44/kg; Fungicide spray cost including /acre; 4500 included; ICBR = Net profit/Plant protection cost

Management of botrytis diseases can be successfully achieved through application of chemical fungicides. However, foliar application of fungicides used at regular intervals with the first appearance of the Botrytis disease can control an epidemic in the crop (Pande *et al.*, 2002) [8]. Similar effective fungicides can be used as a prophylactic spray to manage botrytis fungus include Carbendazim, Captan, Chlorothalonil, Mancozeb, Thiabendazole, Thiophanate-methyl, Thiram, Triadimefon, Triadimenol, or Vinclozolin (Singh and Kaur, 1990; Haware and McDonald, 1992; Bakr *et al.*, 1993; Haware, 1998; Knights and Siddique, 2002; Pande *et al.*, 2002; Davidson *et al.*, 2004; Shahiduzzaman, 2015) [12, 6, 2, 5, 7, 8, 3, 11]. Sometimes multiple sprays are recommended during favourable weather conditions, even though one spray at flowering stage followed by another spray 10 days later on a moderately resistant cultivar provides the best protection against gray mold infection on chickpea (Pande *et al.*, 2002) [8].

Conclusion

The demonstrations on fungicidal management thus showed potential of the timely spray of fungicide propiconazole (0.1%) in management of gray mold, realizing high seed yield and economic benefit to castor growers.

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