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RESEARCH PAPER

Field evaluation of different rapeseed mustard genotypes under semi arid conditions of Punjab

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Abstract : Brassica crops are the important source of edible oil in India, but traditional low yielding genotypes should be replaced with the improved genotypes to meet edible oil requirement of the country domestically. A field study was conducted during *Rabi* 2013-14 and 2014-15 to test the yield response of new genotypes of rapeseed mustards at different locations in Sri Muktsar Sahib district of Punjab. New raya genotype, RLC 3 gave higher average yield (15.21 q/ha) as compared to local check RLC 1 (14.8 q/ha). African sarson genotype PC 10 also produced higher average grain yield (16.48 q/ha) as compared to local check (15.32 q/ha). The incidence of white rust disease was not observed in new genotypes, whereas Alternaria blight incidence was lower as compared to local checks. New genotypes also gave higher per hectare net return as compared to respective local checks. Overall net return from African sarson was better as compared to raya.

Key Words : Alternaria blight, *Brassica*, Genotype, White rust, Yield

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INTRODUCTION

Rapeseed mustard are the major oilseed crop of India which contribute about 32 per cent of the total oilseed production in the country (Thakur and Sohal, 2014). This group of oilseed crops offers higher return with low cost of production and low water requirement, so it has greater potential to increase the availability of edible oil from the domestic production (Singh *et al.*, 2010). It is fit for both irrigated as well as rain fed areas and suitable for sole as well as mixed cropping. Ground water in south western part of the Punjab is of poor quality and soil health is also poor due to monoculture of crops, so it offers a great potential for crop diversification. Oil seed sector as a whole has witnessed significant increase in production in the last decade. The production and yield of rapeseed mustard increased from 6.66 million tonne (mt) and 1017 kg/ha in 2000-01, to 7.66 mt and 1185 kg/ha in 2010-11 (Singh and Kothari, 2013). Despite the high quality of oil and also its wide adaptability for varied agro-climatic conditions, the area, production and yield of rapeseed-mustard in India have been fluctuating due to various biotic and abiotic stresses coupled with India's domestic price support programme. Among biotic stress, white rust caused by *Albugo candida* (Pers. ex. Lev.) Kuntze and Alternaria blight caused by *Alternaria brassicae* (Berk.) Sacc. have been reported to be most wide spread and destructive fungal diseases of rapeseed mustard throughout the world

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(Kolte, 1985 and Kolte, 2002). The temperature ranging from maximum 18-27C and minimum 8-12 °C along with an average relative humidity >92 per cent has been reported to favour the initiation and spread of Alternaria disease on the leaves (Aneja and Agnihotri, 2013). Such conditions prevail during crop season in the Punjab, so disease cause heavy losses to the crop. Depending upon disease severity, Alternaria blight may cause about upto 70 per cent yield loss under Indian condition (Meena *et al.*, 2010; Meena *et al.*, 2011; Chattopadhyay, 2008 and Shrestha *et al.*, 2005). Similarly white rust (*Albugo candida*) is major bottleneck in raya cultivation. About 60 per cent or more yield losses on *Brassica* from white rust disease have been reported in India (Lakra and Saharan, 1989). Since the resistance to these diseases are not present in cultivated varieties of *Brassica* so, efforts are made to select less susceptible cultivars. The seed yield of rapeseed mustard can be increased by identifying and introducing of high yielding genotypes having tolerance to these diseases. The replacement of traditional low yielding genotypes with the improved genotypes is very necessary to meet edible oil requirement of the country domestically. In the present study improved genotypes of rapeseed mustard were evaluated at farmers' field to compare their yield potential, resistant to diseases with the objective to check their suitability under the existing climatic conditions of south western districts of Punjab.

MATERIAL AND METHODS

A multi-location field study was conducted to test the growth and yield response of different *Brassica* cultivars during *Rabi* 2013-14 and 2014-15 at different locations in Sri Muktsar Sahib district (lie between 30° 69' and 29° 87' latitude and 74° 21' and 74° 86' longitude, 184 m above mean sea level). The area is characterized by semi-arid type of climate with hot and dry early summers from April-June followed by hot and humid period during July-September and cold winters during December-January. Winter experiences frequent frosty spells especially during December and January and minimum temperature records as low as 0.5^0C. The annual rainfall of the area is 430.7 mm, most of which is received during July to September (Anonymous, 2007). During *Rabi* 2013-14, four raya cultivars (PHR 1, PHR 2, RLC 1 and RLC 3) and two African sarson cultivar (PC 10 and PC 5) were tested at Krishi Vigyan Kendra, Sri Muktsar Sahib. In *Rabi* 2014-15 experiments were conducted at different locations at farmers' field. Raya cultivar RLC 3 and recommended check RLC 1 were tested at village Jand wala, Balamgarh, Harike Kalan and KVK, Sri Muktsar Sahib. Whereas, African sarson cultivar PC 10 was tested along with PRB 357 (Check) at four different locations *viz.*, village Madhir, Ramgarh Chungah and Chhatianna and KVK farm Sri Muktsar Sahib. Seeds of these cultivars were supplied by Oilseed Section, Deptt. of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana. Physico-chemical analysis of the soil was done from a composite soil sample collected before crop sowing. In these locations, the soil was loamy sand to loam in texture. However, the soil is medium in OC and available P and rich in available K in the all experimental site. The crop was raised as per recommended agronomic practices for cultivation of rapeseed mustard under irrigated conditions (Anonymous, 2013). Sowing was done during first fortnight of November. A basal dose of 112.5 kg urea and 187.5 kg SSP per hectare were applied at the time of sowing and remaining 112.5 kg urea per hectare at first irrigation. The crop was sown in rows at 30 cm apart. After germination, thinning was done to maintain uniform plant population at 10 cm. The data on growth parameters like flower initiation, days to maturity, yield was recorded from whole plot basis. Experiment was laid out in Randomized Complete Block Design. The results were analyzed statistically using analysis of variance (ANOVA) on computer and treatment means were compared using least significant difference (LSD) (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Growth and grain yield :

During *Rabi* 2013-14, a field experiment was conducted to test the growth and yield response of different *Brassica* cultivars. Three new cultivar of raya (PHR 1, PHR 2 and RLC 3) were tested with a local check RLC 1(Table 1). A new cultivar (PC 10) of African sarson was tested with a local check PC 5. The variety PHR 1(147 days) and PHR 2(147 days) mature earlier as compared to RLC 3(149 days) and RLC 1(152 days). Whereas, African sarson cultivar PC 10 take less days for flower initiation as compared to local check PC 5 and it matured earlier as compared to local check during

2013-14. During 2014-15, the performance of new raya cultivar RLC 3 and African sarson cultivar PC 10 was tested at different locations and compared with recommended check RLC 1 and PRB 357, respectively (Table 2). The variety RLC 3 (66) flower early as compared to RLC 1 (68 days) and it also matures two days earlier as compared to local check. Whereas, African sarson PC 10 variety taken more days for flower initiation as compared to local check and also, it matured one week late as compared to local check during 2014-15.

The grain yield during 2013-14, variety RLC 3 produced higher grain yield (14.9q/ha) among all other raya cultivars, followed by PHR 1 (14.5 q/ha), PHR 2 (13.2 q/ha) and lowest in RLC 1 (13q/ha). RLC 3 gave 14.6 per cent higher yield as compared to local check RLC 1. Similarly, new African sarson cultivar PC 10 produced 14.6 per cent higher grain yield (15.6 q/ha) than local check PC 5 (Table 1). During 2014-15, RLC 3 (15.53q/ha) produced statistically at par grain yield with local check RLC 1 (16.6 q/ha). However, African sarson variety PC 10 gave significantly higher yield (17.35 q/ha) than local check (16.05 q/ha).

The pooled average of the two year data, new raya cultivar, RLC 3 (15.21 q/ha) gave higher yield as compared to local check (14.8 q/ha). Similarly, higher per hectare net return was obtained from RLC 3 (Rs. 27682) as compared to RLC 1 (Rs. 26350). New African

Table 1 : Growth and grain yield of Raya and African sarson during 2013-14

Genotypes	Days to flower initiations	Days taken to maturity	Yield q/ha	% superiority over check
Raya				
PHR 1	62	147	14.5	11.53
PHR 2	59	147	13.2	1.5
RLC 3	64	149	14.9	14.6
RLC 1	65	152	13	--
African sarson			0	
PC 10	72	158	15.6	6.4
PC 5	80	164	14.6	--

Table 2 : Growth and grain yield of Raya and African sarson during 2014-15

Genotypes	Days to flower initiation	Days taken to maturity	Yield q/ha	#Average yield q/ha	Net return (Rs.)
Raya					
RLC 3	66	150	15.53	15.21	27682
RLC 1	68	152	16.60	14.8	26350
C.D. (P=0.05)			NS		
African sarson					
PC 10	70	157	17.35	16.48	31794
PBR 357	65	150	16.05	15.32	28056
C.D. (P=0.05)			0.16		

• Selling price @ Rs. 3250/- per quintal, # Average yield of two year data NS= Non-significant

Table 3 : Incidence of disease on Raya and African sarson under natural condition during 2014-15

Genotype	Disease incidence (%)					
	75 days		90 days		105 days	
	White rust	Alternaria blight	White rust	Alternaria blight	White rust	Alternaria blight
Raya						
RLC 3	-	15	-	70	-	80
RLC 1	80	40	90	80	100	100
African sarson						
PC 10	-	10	-	40	-	75
PBR 357	40	30	60	75	80	100

sarson variety PC 10 also produced higher average grain yield (16.48 q/ha) as compared to local check (15.32 q/ha) and PC 10 (Rs. 31794 per ha) gave higher net return as compared to local check (Rs. 28056 per ha). Thus, the results indicated that overall the new cultivars RLC 3 and PC 10 performed better than local checks and obtained higher return. The table also revealed that overall net return from African sarson was better as compared to raya. The differences in the yield of the tested genotypes were due to best performance of genotypes under the existing agro-climatic condition and genetic potential of the genotypes (Yousaf *et al.*, 2013).

Disease incidence :

White rust and Alternaria blight are the major diseases which cause significant yield reduction in raya. The incidence of these diseases under natural condition were recorded at 75, 90 and 105 days and presented in Table 3. At 75 days, the white rust incidence was not observed in RLC 3 as compared to 80 per cent incidence in local check RLC 1. Similarly at 90 and 105 days the incidence of white rust was very high in local check (100%) as compared to no incidence of this disease in new raya cultivar RLC 3. As Alternaria blight is concerned the incidence was again low in RLC 3 (15%) than RLC 1(40%) at 75 days old crop. At 90 days the incidence of disease was 70 per cent and 80 per cent in RLC 3 and RLC 1, respectively which further increased to 80 per cent in RLC 3 and 100 per cent in RLC 1 at 105 days of crop. Hence, new cultivar RLC 3 was free from white rust infestation and Alternaria blight was also low as compared to local check.

In African sarson cultivar PC 10, white rust incidence was not observed at any stage of the crop. Whereas in check PBR 357 the incidence white rust increased from 40 per cent at 75 days old crop to 80 per cent incidence at 105 days. Similarly, the incidence of Alternaria blight was again low in PC 10 (10%) than local check (30%) at 75 days old crop, which increased to 40 per cent and 75 per cent at 90 days in respective cultivars. At 105 days the incidence of disease was 75 per cent and 100 per cent in PC 10 and PBR 357, respectively. So, new African sarson cultivar PC 10 was free from white rust infestation and Alternaria blight was also low as compared to local check. Disease severity significantly affected the seed yield of *Brassica* cultivars. Bal and Kumar (2014) also reported that white rust and Alternaria blight infest the crop under Punjab condition and significantly affected the seed yield of *Brassica*. Management of these diseases by use of different fungicides with varying degree of success has been reported in the literature (Mehta *et al.,* 2005 and Rohila *et al.*, 2001). For the management of these diseases, PAU, Ludhiana recommended 1st spray of blitox (copper oxychloride) or indofil M-45 (mancozeb) @ 250 g in 100 lit. of water per acre at 75 days old crop followed by second spray of score 25 EC (difenoconazole) @ 100 ml and third spray of blitox or indofil M-45 @ 250 g in 100 lit. of water per acre at 15 days interval (Anonymous, 2013). Thus, new genotypes RLC 3 and PC 10 received lower disease incidence which can be manage by fungicidal spray schedule recommended under Punjab condition.

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