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Research Article

Influence of Plant Population on Weed Infestation and Yield of Rapeseed Cultivars

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Abstract

Plant population densities highly affect architectural characteristics of plant and ultimately weeds infestation is affected. An experiment was conducted in randomized complete block design with three replications at Palatoo Research Farm, Amir Muhammad Khan Campus Mardan, The University of Agriculture Peshawar Pakistan during 2015-16 to investigate the effect of plant spacing and two cultivars (Zahoor and NARC) on seed yield and weeds infestation. The effect of different plant spacing i.e. (10, 15 and 20 cm) and two cultivars (Zahoor and NARC) were analyzed in this study. Results of the study indicated that plant spacing and cultivars had significant effect on weed infestation. Among the spacing 10 cm showed good competition with weeds and maximum yield was also obtained with 10 cm spacing along using zahoor variety. It is concluded that cv. zahoor were highly resistance to weeds due to faster growth and recommended for cultivation in the agro-ecological condition of Mardan.

Keywords: *Grain Yield; Weeds Density; Fresh and Dry Weight of Weeds*

Introduction

Rapeseed (*Brassica napus* L.) is an important oil crop originated in mediterranean region of south west Europe by natural hybridization [1]. Its seeds contain 40 - 45% of cooking oil and are a good alternate source of soya bean oil in Pakistan [2]. Among other oil crops such as soya bean, cotton, peanut and sunflower, the production of rapeseed is higher in this era and its production becomes in third order from fifth order around the world. The European countries have the maximum capacity production of canola are range of 3500 kg ha^{-1}, Canada 3200 kg ha^{-1} and Australia 2000 kg ha^{-1} [3]. During 2011-12 in Pakistan the rapeseed was cultivated in 14700 ha with the production of 7000 tones, while Khyber Phakhtunkhwa the area under cultivation was 1300 ha with a total production of 1800 tones [4]. Rapeseed cultivars oil have more notorious value in compare with other oil agronomic crops due to its more unsaturated fatty acids one method to improving seed yield m^{-2} is using hybrid cultivars adoptable to climate conditions. In rapeseed, row spacing or plant population vary acceptable worldwide, depending on the environment, production system and cultivar. Previous studies reported that plant population is a significant reason effecting canola yield. Plant population in canola crops governs the components of yield, and so the yield of separate plants. The aims such is improving refracted sunlight by changing plant population and also change row spacing perused agronomic crops [5,6]. The lower yield of rapeseed in Pakistan is due to the serious weeds infestations in the fields. Weeds reduce the quantity and quality of crops and compete for moisture, nutrients, space and sunlight [7]. Leaf area index decline in the weed-infested field due to competition between crop and weed [8]. One of the effective methods in weeds settlement is to accepted cultivars having more ability of competition with weeds and to recognize the impressible characters in order to produce capable cultivars in weeds sustainable management [9].

One the most important method is the use of improved cultivars with high production potential and vigor may enhance the yield of the crop. The selection of suitable variety always plays a vital role in achieving high yield of a crop [10]. Differences in cultivars exhibited for stature, vigorous, denser canopy, and are more weed-competitive among each other [11]. Seed yield increased by 78% relative to the current farmer's practices of selective and partial hand weeding [12]. A key component of these approaches is the enhancement of crop competitiveness against weeds [13]. Manipulating agronomic factors such as row and plant spacing may provide a non-chemical means of reducing the impact of weed interference on crop yields.

Aim of the Study

The present experiment is hence designed with the aim to compare two improved rapeseed cultivars and find out the suitable plant spacing for each cultivar for higher yield and reducing weed infestation in the agro ecological condition of Mardan.

Materials and Methods

To study the effect of plant spacing and cultivars on weed infestation and yield a field experiment was conducted Palatoo Research Farm Amir Muhammad Khan Campus Mardan, The University of Agriculture Peshawar, Pakistan during 2015-16. Rapeseed cultivars (Zahoor and NARC) were sown in 3rd week of November 2015 with a uniform seed rate of 2.5 kg ha^{-1} on a well prepared and fine seed bed. The experiment was laid out in a randomized complete block design having three replications. The effect of three plant spacing (10, 15 and 20 cm) and two cultivars of rapeseed i.e. (Zahoor and NARC) were analyzed in the experiment. The size of plot was kept 1.3 × 1.5 m^2 having row to row distance of 50 cm. For maintaining required plant to plant distance (10, 15 and 20 cm) thinning was done after 25 days after sowing. The field was irrigated according to environmental condition and crop requirement. Data were recorded on number of weeds, fresh and dry weeds biomass and seed yield of rapeseed.

Tables of varieties and its origin

Varieties Name	Originated from
NARC	NIFA Peshawar
Zahoor	Agriculture university Peshawar

Data recording procedure

Weed density was recorded by uprooting weeds from 50 cm meter area using at two randomly selected places in each plot. Fresh biomass of weeds were determined by measuring the uprooted fresh weeds in each plot using electronic balanced and was recorded in g m^{-2}. For weed dry weight (g m^{-2}) data, the uprooted weeds from each plot were oven dried at 72°C for 24 hours. For recording seed yield data of rapeseed, two central rows were harvested from each plot using a sickle and were sun dried for 10 days and then threshed. The grains collected were weighted with electronic balance and converted in to kg ha^{-1}.

Statistical analysis

The data were analyzed through analysis of variance (ANOVA) techniques suitable for randomized complete block design and the variations amongst the treatments were compared through LSD-test of significance at the p level of $p < 0.05$ [13].

Results

Weeds density (plants m^{-2})

Data regarding weed density are given in table 1. Statistical analysis of the data showed that the plant spacing and cultivars had no significant affect on densities of *F. indica*, *E. helioscopia and R. dentatus*. The interactions was also found non significant for all identified weeds (*F. indica*, *E. helioscopia and R. dentatus*).

Plant spacing (cm)	F. indica (m^{-2})	E. helioscopia (m^{-2})	R. dentatus (m^{-2})
10	24.6	24.3	23.7
15	25.7	27.0	25.3
20	26.3	26.2	26.3
LSD	NS	NS	NS
Cultivars			
Zahoor	25.8	25.1	23.6
NARC	25.2	26.5	26.6
Significance	NS	NS	NS
P×V	NS	NS	NS

Table 1: *Weed density m^{-2} of Fumaria indica, Euphorbia helioscopia and rumex dentatus of Brassica cultivars as influenced by plant population.*

Fresh biomass of weeds (g m^{-2})

Data on fresh biomass are presented in table 2. Statistical analysis of the data showed that the fresh biomass of *F. indica* and *E. helioscopia* were significantly affected by plant spacing while *R. dentatus* was found statistically same in all plant spacing. The fresh biomass of *R. dentatus* and *F. indica* significantly varied in cultivars while *E. helioscopia* were found statistically same in both cultivars. The interaction between cultivar and plant spacing were found significant for all identified weeds except *F. indica*. The fresh biomass of *R. dentatus* was higher (184.3 g m^{-2}) in Zahoor cultivar. The probable reason for this might be due to genetic superiority of a verity. Maximum fresh biomass of *F. indica* and *E. helioscopia* was recorded in a plant to plant spacing of 20 cm (190.0 g m^{-2}) and (216.1 g m^{-2}) as compare to other plant spacing.

Plant spacing (cm)	F. indica (g m^{-2})	E. helioscopia (g m^{-2})	R. dentatus (g m^{-2})
10	163.4b	193.6b	174.2
15	176.2b	206.9a	168.0
20	203.8a	216.1a	180.2
LSD	21.37	17.95	NS
Cultivars			
Zahoor	188.2a	202.2	184.3a
NARC	164.9b	208.8	164.0b
Significance	*	NS	*
P×V	NS	*	*

Table 2: *Fresh weight (g m^{-2}) of fumaria indica, euphorbia helioscopia and rumex dentatus of Brassica cultivars as influenced by plant population.*

Dry biomass of weeds (g m-2)

Statistical analysis of the data in table 3 showed that the dry biomass of *F. indica* and *R. dentatus* was significantly varied among plant spacing while *E. helioscopia* was found non-significant. Rapeseed cultivars had no significant affect on weeds dry bio mass. The interaction

between cultivar and plant spacing was found non significant for all identified weeds (*F. indica, E. helioscopia* and *R. dentatus*). Higher dry biomass of *R. dentatus* (31.0 g m^{-2}) were recorded in a spacing 20 cm as compare to 15 cm plant spacing (27.9 g m^{-2}) and 10 cm of plant spacing (25.9 g m^{-2}).

Plant spacing (cm)	F. indica (g m^{-2})	E. helioscopia (g m^{-2})	R. dentatus (g m^{-2})
10	25.9b	30.2	28.7a
15	27.9b	32.1	24.9b
20	31.0a	27.5	29.7a
LSD	3.80	NS	3.93
Cultivars			
Zahoor	28.8	28.5	28.5
NARC	27.7	31.3	27.0
Significance	NS	NS	NS
P×V	NS	NS	NS

Table 3: *Dry weight (g m^{-2}) of fumaria indica, euphorbia helioscopia and rumex dentatus of Brassica cultivars as influenced by plant population.*

Seed yield (kg ha-1)

Data on seed yield of rapeseed affected by plant spacing of different genotype are presented in table 4. Statistical analysis of the data indicates that seed yield of rapeseed was significantly affected by plant spacing and different genotypes, whereas its interaction was also found significant. Plant spacing of 10 cm produce higher seed yield (2418.5 kg ha^{-1}) as compared to 15 and 20 cm spacing.

Plant spacing (cm)	Seed yield (kg ha^{-1})
10	2418.5a
15	2298.6b
20	2176.2c
LSD	105.46
Cultivars	
Zahoor	2343.1a
NARC	2252.4b
Significance	*
P×V	*

Table 4: *Seed yield of Brassica cultivars as influenced by plant population.*
Means of the same category followed by different letters are significantly different from each other using LSD test at 0.05 level of probability.
*NS = Non-significant, * = Significant at 0.05 level of probability.*

Discussion

Plant spacing had great influence the architectural characteristics of plant which ultimately affect weeds infestation. It is major agronomic practice for good management of weed infestation on sustainable basis. An optimum plants pacing with the use of suitable cultivar may reduce weeds infestation. Weeds density (numbers of weeds m^{-2}) in the study was not influence by plant spacing as well as cultivar, for which the possible reason might be that the germination is inherited property of the seed and cannot be altar by changing plant spacing and using of different cultivar. The fresh biomass (g m^{-2}) of weeds increases with the use of wider spacing and weeds fresh biomass decreases with narrow spacing between plants. For which the possible reason might be the dense canopy prepare rapid photo-assimilate and reduce the light interception so the dry matter accumulation in weeds reduce. Our results conform the findings of [14] observed that the higher density of 270 plants m^{-2} reduced the adverse effects of weeds on yield significantly. Among the genotypes NARC were found to be the best competitor of weeds and reduces weeds fresh biomass accumulation. Similarly weeds dry biomass accumulation also reduces with the use of narrow spacing, which could be explain that due to dense population the crop canopy cover ground area rapidly and decreases the dry matter accumulation. Our results are in line with [15] observed that the higher plant density (i.e. 110 plants m^{-2}) produced more dry matter and augmented leaf area index. The yield of rapeseed was found maximum with dense plant population and this is due to the fact that dense populations efficiently utilize the available nutrients. Our results are in consistent with [16-18] indicating that increasing planting density increases the seed yield. Among genotypes cv zahoor appears most superior and produce the highest seed yield, This high yield might be due to the genetic superiority of the genotype and its efficiency of nutrient uptake and competition with weeds. These results are in line with [19] found different yield with different genotype.

Conclusion

From the results discussed it is concluded that cv. Zahoor with a plant spacing of 10 cm reduces weeds infestation and produce higher yield. So cv. Zahoor with a plant to plant spacing of 10 cm is recommended for farmer cultivation in the agro-ecological condition of Mardan.

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