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Evaluation of Brassica Varieties as Affected by Various Sowing Methods in Peshawar Valley

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Abstract

This study aimed to evaluate the effect of sowing methods on varietal performance and yield of brassica under agro-climatic conditions of Peshawar valley. The experiment was conducted at Pakistan Academy for Rural Development (PARD), Peshawar in Randomized Complete Block Design (RCBD) with three replications. Three brassica varieties (Zahoor, Abaseen-95 and advance line) and three sowing methods (Ridge, Line, and Broadcast) were studied. Statistical analysis of the data revealed that varieties had a significant effect on days to emergence, emergence m^{-2}, and days to flowering, number of branches $plant^{-1}$, number of pods $plant^{-1}$, and number of leaves $plant^{-1}$, leaf area, plant height, and seed pod^{-1}. The increases in yield components were recorded for Zahoor variety as compared with abseen-95 and advance line.

Sowing method showed significant effect on emergence m-2, days to flowering, number of branches plant-1, number of pods plant-1, and number of leaves $plant^{-1}$, leaf area, plant height, and seed pod^{-1}. The interactive effect of varieties and sowing methods had significant effect on number of grain pod^{-1}. The data further revealed that plots sown with Zahoor showed maximum emergence m^{-2} (48.7), and early days to flowering (87.8), number of branches $plant^{-1}$ (7.9), number of pod $plant^{-1}$ (203.1), number of leaves $plant^{-1}$ (18.6), leaf area (569.4), plant height (23.7), and seed pod^{-1} (165.1). It is concluded that Zahoor variety sown on ridge method produced better yield components when compare with other brassica varieties under varying sowing methods.

Keywords: Varieties; Sowing methods; Growth; Yield and yield traits and Brassica

Introduction

Rapeseed (*Brassica napus L.*), is a bright yellow flowering oilseed crop and is member of the family Brassicaceae. Rape seed is mostly cultivated for the production of edible oil, animal feed as well as biodiesel etc. European union, Canada, USA, Australia, China and India are the leading producer of rapeseed. Rape seed is a famous with about 160 species within brassica. The most commonly found six species are B. nigra, B. carinata, B. jnica, B. oleracea, B. comperstris and B. napus Holmes [1]. The word rape is derived from the latin word rapum meaning turnip Wesis (1983). As fodder crop raped seed or mustard seed was grown about 300 BC in Indus valley of sub-continent, while in fifteenth century its oil use started. Up to the Second World War (1945) the oil was used as lubricant and lamp oil Weisis (1983).

The existence of erucic acid and glucosinolate in the tissues, which has bitter taste in addition, it is toxic for human and animal's health, it could not get an important place as an oil crop Muhammad et al. [2]. Reduction in these compounds by plant breeders in canada has made mustard the world's third valuable vegetable oil Downey & Rimmer [3]. Today there is high demand for oil by diet-conscious consumers because in lowest in saturated fat content among vegetables oil Grombacher & Nelson [4]. Seed use as source of oil while leaves use as a vegetable. The meal left after extraction use as a livestock feed rich source of protein Khalil et al. [5] as Rape is 60-70% self-pollinated and the remainder cross pollination being by inset, wind and mostly b honeybees Holmes [1]. Brassica oil seed cultivars are third major source of edible oil in the world, after soybean and groundnut. Is an annual rabi crop, 50-200cm tall and branched with tap root system and may lateral roots concentrated in the shallow sub-surface soil, and young leaves of rapeseed used as vegetable and fodder, while oil use for cooking and pickles Hatam & Abbasi [6].

According to FAO report the production of rapeseed has increased by six folds since 1975 up to 2004 FAO [7]. The edible oil market has opened for rapeseed oil due to the production of canola since 1975. The production is thus expected to be more as biodiesel between 2005 and 2015 due to increasing requirements of energy in Europe FAO [7]. Round about 400kg of edible oil can be obtained from a ton of rapeseed. Production of rapeseed is growing most rapidly it was reported that 36 million tons of the rapeseed was produced during the 2003-04 and an increase was estimated up to 58.4million tons up to 2010-11 FAO [7]. In Pakistan during 2008-09, 245 thousand ha of area

was cultivated with rapeseed which produced 199 thousand tons of rapeseed with average yield of 812kg ha^{-1} MINFA [8]. While during 2010-11, the cultivated area of canola was reduced to 217 thousand ha and canola production decreased to 192 thousand tones while the average yield was increased to 886kg ha^{-1}. In Khyber Pakhtunkhwa during 2010-11, rapeseed and canola occupied 17.1 thousand ha which produced 7.9 thousand tones with average yield of 450kg ha^{-1} MINFA (2011).

Although grazing before duds are visible delays flowering which ranged from 0-4days yet brassica has the ability to recover well from heavy grazing, and if the crop was already flowering this delay further increased to 28 days. If the spring conditions are unfavorable significant delay in flowering causes yield reductions Kirkegaard et al. [9]. In light of the fore mentioned discussions, it is evident that both new variety and good sowing method increasing oil content, quality and grain yield, thus the study will be initiated with aim to evaluate the effect of different sowing methods and varieties on yield and quality of rape seed (*Brassica compretris L.*).

The sowing of two rows in furrows and ridges spaced 90 cm produced 24% higher seed yield whereas paired sowing (30 cm: 60 cm) produced 20% higher seed yield than 45 cm spaced row sowing of B.napus. They observed that radiation interception, accumulation and partitioning of dry matter and leaf area in this system were beneficial for exploiting the input resources Bishnoi et al. (1991). The root growth parameters increased with increase in N level from early vegetative phase on ridge sowing method sizeable early buildup of above ground plant infrastructure and ultimately high seed yield and N uptake was observed in B. napus Narang & Gill (1992). Keeping in view the importance of varieties, sowing methods the present experiment was conducted.

Materials and Methods

To study the effect of sowing methods on varietal performance and yield of brassica, experiment was conducted at Pakistan Academy for Rural Development (PARD) comprises of three cultivars (abaseen-95, Zahoor and advance line) with three different sowing methods (ridge, line and broadcast) in Randomized Complete Block Design with plot size 5m X 3m ($15m^2$) accommodating 5 rows with 30 cm distance replicated three times. A fine seedbed was prepared with the help of cultivator and rotavator. Phosphorus was applied at the rate of 60 kg ha^{-1} in the form of DAP prior to sowing with seed bed preparation. Seeds were sown by hand drill in rows and ridge while broadcast with a constant seed rate of 5 kg ha^{-1} on 2nd October 2016. Nitrogen was applied at the rate of 100 kg ha^{-1} as per treatment requirements in split dose i.e. half at sowing and half at flowering stage from Urea. After emergence completed, thinning was done to maintain a constant plant to plant distance of 10 cm. The initial irrigation was applied on 11th October while the second irrigation was applied on 30th October. Later on the field was irrigated as and when needed. For insect control insecticide lambda and cypermethrin 2.5% was applied at the rate of 250 ml acre-1. Weeding was done with the help of hand hoeing and all other culture practice was uniform for all treatments.

Data were recorded on days to emergence and flowering by counting number of days from the sowing date till 80% plants emerged and flowered respectively in each plot. Emergence m^{-2} was recorded by counting the number of plants in on meter long area at three different places in each treatment then converted to m^{-2}.Branch $plant^{-1}$, pods $plant^{-1}$, number of seeds per plant and leaves $plant^{-1}$ was recorded by taking ten samples from each subunit and then averaged. Leaf area was measured by taking a sample of five representative plants from each plot leaves were separated and average leaf area was measured with the help of a leaf area meter (CI-202, USA). Plant height was recorded by measuring the height of ten randomly selected plants from ground level to the top of the plant in each plot at physiological maturity and then their average was calculated. Statistical analysis was done using analysis of variance technique. Means were

compared using LSD test at 0.05 level of probability, when the F-values were significant Jan et al. (2009).

Results

Days to Emergence

Data regarding emergence of brassica are given in (Table 1). Varieties (V) significantly affected days to emergence while effect of sowing method was non-significant. Brassica cultivar Zahoor took 5.8 days to emergence followed by Cultivar Abaseen 7.8 days to emergence, which is statistically at par with advance line. The interactive effect between cultivars and sowing method was not significant for days to emergence. Brassica cultivar Zahoor took significantly lower days to emergence than Abaseen-95 and Advance line. This could be probably because at the time of emergence the indigenous reserved food materials of the seed are utilized and germination is usually not affected by soil nutrient status. These results agree with that of Sultana et al. [10] who find out those different cultivars have different days to emergence.

Table 1: Days to emergence of brassica as affected by varieties and sowing methods.

Varieties (V)	Sowing Methods (SM)			
	Ridge	Line	Broadcast	Mean
Zahoor	5.7	5.7	6.0	5.8 b
Abaseen-95	7.3	7.3	8.0	7.6 a
Advance line	6.7	7.0	9.0	7.8 a
Mean	6.6	6.7	7.9	

LSD value for V=1.2106.
LSD value for SM= Ns.
LSD value for VxSM= Ns.

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Emergence m^{-2}

Emergence m^{-2} of brassica is significantly affected by Cultivars and sowing methods as shown in (Table 2). Analysis of the data showed that brassica cultivar Zahoor had the highest emergence m-2 (48.7m-2) followed by Abaseen-95 (42.3m^{-2}) and Advance line (39.4m^{-2}). Similarly, all interaction between sowing methods and cultivar were also found significantly. More number of plants was recorded When Zahoor was grown on ridge method (46 m^{-2}) while less number of plants was recorded when advance line grown on broadcast method (42.9 m^{-2}). Cultivars significantly affected emergence m^{-2} of brassica. Brassica cultivar Zahoor had the highest emergence m^{-2} than Abseen-95 and Advance line. This could be probably due to the fact that at the time of emergence the indigenous reserved food materials of the seed are utilized and germination is usually not affected by soil nutrient status. These results are confirmed by Sultana et al. [10] who found that different cultivars have different germination power.

Table 2: Emergence m^{-2} of brassica as affected by varieties and sowing methods.

Varieties (V)	Sowing Methods (SM)			
	Ridge	Line	Broadcast	Mean
Zahoor	58.0	43.0	45.0	48.7a
Abaseen-95	46.0	40.0	41.0	42.3b
Advance line	35.7	40.0	42.7	39.9b
Mean	46.6 a	41.0 b	42.9ab	

LSD value for V=3.8482.

LSD value for SM=3.8482.

LSD value for V x SM= *

Days to flowering

Data regarding days to flowering of brassica are given in (Table 3). Days to flowering significantly affected by sowing method and cultivars. Similarly, the interactive effect was also significant. Statistical analysis showed that Early flowering (87.8 days) was observed in Zahoor variety as compared to late flowering observed in advance line variety (108.3 days). Early flowering was noted on ridge method (93.6) while late was noted on broadcast (101.3). Similarly interactive effect of sowing method and varieties were also found significant when sowing was done on ridge early flower occur (82.7). Mean value of the data showed that days to flowering were significantly affected by varieties and sowing method. It is clear from the data that more days to flowering were taken by advance line, while less days to flowering were taken by Zahoor. This could be due to the fact that flowering is a physiological process and mainly affected by genotypes and environment. Rahman [11] reported that the effect of varieties was significant on all parameter. The data show that more days to flowering were observed in broadcast method. less days to flowering were noted in ridge method. This might be due to the fact that ridge method created better soil enviroment for proper root development and efficient supply of nutrients.

Table 3: Days to flowering of brassica as affected by varieties and sowing methods.

Varieties (V)	Sowing Methods (SM)			
	Ridge	Line	Broadcast	Mean
Zahoor	89.7	91.0	82.7	87.8c
Abaseen-95	96.3	86.3	112.3	98.3b
Advance line	94.7	121.3	109.0	108.3a
Mean	93.6b	99.6a	101.3a	

LSD value for V=5.7536.

LSD value for SM=5.7536.

LSD value for V x SM= *

Branches $plant^{-1}$

Data concerning branches $plant^{-1}$ of brassica are tabulated in (Table 4). Perusal of data showed a significant response of branches $plant^{-1}$ to cultivars and sowing methods. The Interaction between V x MS was found not significantly for branches $plant^{-1}$. Brassica cultivar Zahoor produced significantly higher branches $plant^{-1}$ (7.9) while low branches were observed in Advance line (5.3). Sowing method had significant effect was found when Zahoor sowing done on ridge method maximum branches $plant^{-1}$ was recorded (7.6) while less were recorded for advance line when sown on broadcast method (4.2). Statistical analysis of the data revealed that branches $plant^{-1}$ was significantly affected by varieties and sowing method. The interaction between varieties and sowing method was non significant. The data showed that more number of branches were recored in Zahoor while less for abvance line. This could be due to the genetic characters of the variety. The data show that more braches $plant^{-1}$ were observed in ridge method wile less were observed in broadcast method. This might be due to the fact that the closer plant population at broadcasting method, there were competitions for light, space, nutrients and environments and therefore, lowest number of branches $plant^{-1}$.

Table 4: Number of branch $plant^{-1}$of brassica as affected by varieties and sowing methods.

Varieties (V)	Sowing Methods (SM)			
	Ridge	Line	Broadcast	Mean
Zahoor	9.7	8.0	6.0	7.9a
Abaseen-95	6.0	7.3	3.3	5.6b
Advance line	7.0	5.7	3.3	5.3b
Mean	7.6a	7.0a	4.2b	

LSD value for V=1.4067.

LSD value for SM=1.4067.

LSD value for V x SM= Ns.

Pods $plant^{-1}$

Data on pods $plant^{-1}$ is reported in (Table 5). Statistical analysis showed that Cultivars and sowing method had significantly effect on pods $plant^{-1}$. The combine effect of sowing method and cultivar were found non-significant. Higher number of pods $plant^{-1}$ (203.1) was produced by the cultivar Zahoor

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followed by Abaseen-95 (184.7) and advance line (156.6) it is evident from mean data that when sowing was done on ridge method higher pods plant^{-1} (224) was recorded while less pods (143) was recorded when sowing was done on broadcast method. Pods plant^{-1} was significantly affected by cultivars and sowing methods.

Table 5: Number of pods plant^{-1} of brassica as affected by varieties and sowing methods.

Varieties (V)	Sowing Methods (SM)			
	Ridge	Line	Broadcast	Mean
Zahoor	240.0	198.7	170.7	203.1a
Abaseen-95	227.7	191.3	135.0	184.7b
Advance line	205.0	140.7	124.0	156.6c
Mean	224.2a	176.9b	143.2c	

LSD value for V=14.383.

LSD value for SM=14.383.

LSD value for V x SM= Ns.

The interactive response cultivar and sowing method were non-significant. Higher pods plant^{-1} was produced by the brassica cultivar Zahoor while less pods plant^{-1} was produced by advance line. This might be due to variation in varietal characteristics that deviated in their expression from each other. It is evident from the data that more pods plant^{-1} were attained from ridge method while less from pods plant^{-1} were recorded in broadcast method. This might be due to the fact that ridge method provide better soil environment for nutrients and moisture uptake and also make soil pores. Similar results were also reported by khan et al. [12] who investigated that maximum pods plant^{-1} produced by ridge method sowing.

Leaves plant-1

The data on number of leaves plant^{-1} of brassica varieties planting at different sowing method is presented in (Table 6). Mean value of the data showed that cultivar and sowing methods had significant effect on number of leaves plant^{-1}. Interaction between cultivar and sowing method were found non-significant. The maximum number leaves plant^{-1} (18.6) in case of Zahoor. This is followed by abaseen-95 with a number of leaves plant^{-1} of (15.8) and minimum number of leaves plant^{-1} was recorded from advance line (14.3). In sowing method maximum number of leaves plant^{-1} (16.8) was recorded from plants planted at ridge method while minimum number of leaves plant^{-1} (15.4) was recorded from plants planted at broadcast method. Analysis of the data revealed that number of leaves plant^{-1} was significantly affected by cultivar and sowing methods. The combine effect of sowing method and cultivar was non-significant. The data showed that Maximum number of leaves plant^{-1} was recorded in Zahoor while minimum number of leaves plant^{-1} was observed in advance line. This might be due to variable soil environment in term of sowing method. Leaves may be influenced by plant population, climate and soil fertility. Efficient utilization of soil resources may also influence number of leaves plant^{-1}. These results are in agreement with Park et al. (1989). The data further showed maximum number of leaves plant^{-1} ridge method while minimum was recorded in broadcast method. This might be due to competition within plants and availability of sufficient space, nutrients and sunlight for plant growth.

Table 6: Number of leaves plant^{-1} of brassica as affected by varieties and sowing methods.

Varieties (V)	Sowing Methods (SM)			
	Ridge	Line	Broadcast	Mean
Zahoor	18.7	18.7	18.3	18.6a
Abaseen-95	17.0	16.7	13.7	15.8b
Advance line	14.7	14.0	14.3	14.3c
Mean	16.8a	16.4ab	15.4b	

LSD value for V=1.0131.

LSD value for SM=1.0131.

LSD value for V x SM= *

Leaf area (cm^2)

Data concerning leaf area plant^{-1} of brassica are given in (Table 7). Cultivars and sowing method had significant response for leaf area plant^{-1}. The interactions between V x SM were also significant for leaf area plant^{-1}. Statistical analysis showed that high leaf area (569.4) was record for Zahoorand less for advance line (326.8). In sowing methods high leaf area (493.2) noted on ridge method while less for broadcast method (358.6). The interaction between cultivar and sowing methods was noted, maximum leaf area (705.7) was observed from Zahoor when grown on ridge method while less was recorded from advance line when grown on broadcast method (312.7). Leaf area plant^{-1} was significantly affected by varieties and sowing method.

Table 7: Leaf area (cm^{-2}) of brassica as affected by varieties and sowing methods.

Varieties (V)	Sowing Methods (SM)			
	Ridge	Line	Broadcast	Mean
Zahoor	705.7	567.3	435.3	569.4a
Abaseen-95	458.0	469.0	312.7	413.2b
Advance line	316.0	336.7	327.7	326.8c
Mean	493.2a	457.7b	358.6c	

LSD value for V=27.418.

LSD value for SM=27.418.

LSD value for V x SM= *

The interactive effect of planting method and varieties were significant. It is obvious from the data that highest leaf area plant^{-1} were observed in Zahoor while less leaf area plant^{-1} were noted from advance line. This might be due to genetic variability of the variety. The data further showed that maximum leaf area were attained from ridge method while minimum leaf area from broadcast method. This might be due to the fact that

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ridge method had more availability of nutrients and better soil aeration as compare to flat field. Similar results were also reported by Hamid et al. [13] who investigated that highest leaf area and leaf area index increase linearly and then decrease due to senescing process in soybean.

Plant height (cm)

Data on plant height are given in (Table 8). Cultivars had significantly affected plant height of brassica. Statistical analysis showed that taller plants (165.1) were observed for cultivar Zahoor, followed by abaseen-95 (160.9) and advanced line (146.0). Sowing methods had also significantly affected plant height. Taller plants (192.1) were recorded in plots where sowing done on ridge while dwarf (115.6) plant were recorded in plots where sowing done on broadcast. The interactive response of cultivar and sowing method was found significant. The taller plants (205.7) were recorded for cultivar Zahoor when planted on ridge while dwarf plants were recorded for advance line when planted on broadcast method (98.7). Mean values of the data indicated that plant height was significantly affected by varieties and planting methods.

Table 8: Plant height of brassica as affected by varieties and sowing methods.

Varieties (V)	Sowing Methods (SM)			
	Ridge	Line	Broadcast	Mean
Zahoor	191.3	155.0	149.0	165.1a
Abaseen-95	205.0	178.7	99.0	160.9a
Advance line	180.0	159.3	98.7	146.0b
Mean	192.1a	164.3b	115.6c	

LSD value for V=5.192686.

LSD value for SM=5.192686.

LSD value for V x SM= *

The combined effect of varieties and planting methods was non-significant. It can be seen from the data that maximum plant height was recorded in variety Zahoor, while minimum plant height was obtained from advance line. This might be due to variation in varietal characteristics that showed their expression from each other. Ali (2008) also confirmed that plant height was significantly affected by varieties. It is evident from the data that taller plants were attained from ridge planting, while smaller plants were recorded in broadcast planting. This might be due to the fact that ridge provide loose fertile soil with more aeration and moisture availability; therefore improved soil condition along with better uptake of nutrients might have provided better environment to crop resulting in improved plant height. Our finding is agree with Khan et al. [14] and Gul et al. [15] who reported that maximum plant height under ridge sowing were observed.

Seeds pod^{-1}

Data on number of seeds pod^{-1} are presented in (Table 9). Cultivar and sowing method had significantly effect on number of Seeds per pod of brassica [16-19]. Similarly the interactive effect between V x SM also had significantly affected. Higher seeds pod^{-1} (23.7) was recorded for Zahoor followed by Abaseen-95 (21.4) and advance line (13.4) [20]. The sowing method were found significant higher seed pod^{-1} were on ridge method (20.6) while less for broadcast method (18.3) Similarly All interaction were found significant for number of seed pod^{-1}. When Zahoor was grown on ridge higher number of seed pod^{-1} (24.7) while less seed pod^{-1} advance line when grown on broadcast method (13.3) [22-24].

Table 9: Seeds pod^{-1} of brassica as affected by varieties and sowing methods.

Varieties (V)	Sowing Methods (SM)			
	Ridge	Line	Broadcast	Mean
Zahoor	24.7	24.7	21.7	23.7a
Abaseen-95	23.7	20.7	20.0	21.4b
Advance line	13.3	13.7	13.3	13.4c
Mean	20.6a	19.7a	18.3b	

LSD value for V=1.0708.

LSD value for SM=1.0708.

LSD value for V x SM= Ns.

Cultivars and planting methods had significant effects on seeds pod^{-1} of brassica. The interactive effect of sowing method and cultivar was non-significantly. Higher number of seeds pod^{-1} was recorded for Zahoor followed by abaseen-95 and advance line [25]. These results are also confirmed by Sultana et al. [10] who stated that cultivar (SAU Sarisha I) produced high number of seed pod^{-1} as compared to Kollania and improved cultivar Tori 7. Similarly, the ridge method produced significantly higher number of seeds pod^{-1} as compared to broadcast method [26]. This might be due to the fact that ridge method had more availability of nutrients and better soil aeration as compare to flat field.

Conclusion and Recommendations

It is concluded from the study that variety Zahoor produced optimum grain yield when planted in ridge method followed by Abaseen-95 when compared with advance line. Among the sowing methods optimum performance of the varieties were recorded by line sowing method after ridge sowing method. Based on said conclusions variety Zahoor and ridge sowing method is recommended for optimum grain yield of brassica in Peshawar valley.

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