J. App. Em. Sc: 1(1) 176-187, June 2004

THE ANALYSIS OF NATURE OF INTERFERENCE BETWEEN THE CROPS OF *BRASSICA* SPECIES.

Aman ullah Salarzai* U.A.Buriro**, and A.A.Jhakro*** and M.B.Kumbhar****

ABSTRACT.

The investigation was carried out to evaluate the influence of plant population on the seed yield and oil content of *Brassica species.* The selected species were (*Brassica napus* L.) cv. Rainbow and (*Brassica campestris* L.) cv. indigenous Gaj. Three each of inter (25,35,45cm) and intra (8,12,16cm), row spacing with plant population 36.08,25.72,20.00,37.79, 25.19 and 18.83 plants m^{-2} were included. The results indicated that increase in inter and intra row spacing significantly increased the number of pods per plants, seed yield and oil contents. The canola cv. Rainbow gave more number of $pods^{-1}$, greater seed yield and oil contents than indigenous cv. Gaj, respectively. It is suggested that for obtaining better yield in *Brassica* species the crop should be sown at 24 plants m^{-2}.

INTRODUCTION

The adoption of improved technology coupled with sowing time, row spacing and high yielding varieties can improve the productivity substantially. Plant manifests a remarkable capacity to exploit the environment with varying competitive stresses. Too wide row spacing may not utilize the natural resources efficiently, whereas narrower row spacing may result in sever inter and intra-row spacing competition. Therefore there is a need to manipulate the row spacing competition and to increase plant productivity. If an unfavorable aerial environment restricts plant growth, the response to plant population varies with the availability of soil moisture.

* Directorate General of Agriculture (Extension) Rani Bagh Quetta, Pakistan

** Department of Agronomy Sindh Agriculture University Tandojam,Pakistan.

***Department of Soil Science Sindh Agriculture University Tandojam,Pakistan

**** Department of Plant breeding & Genetics Sindh Agriculture University Tandojam,Pakistan.

An investigation was carried out to know the optimum plant density of newly introduced promising canola cv. Rainbow with comparison indigenous cv. Gaj sarson under the agro-climatic conditions of Tando jam during 2002-003 for getting maximum yield.

MATERIAL & METHODS

The experiment was conducted to evaluate the effect of inter and intra-row spacing on the yield and oil contents of Brassica species at Agronomic Research area, Sindh Agriculture University, Tando jam. Crop was planted in 3.5 x 5.0 m plot area in RCBD (with factorial arrangement) design with four replications. Main row spacing were 25,35,45cm and sub plot spacing 8,12,16 cm. As a result of these spacing 36.08, 25.72, 20.00, 37.79, 25.19 and 18.83 plants m^{-2} were maintained. A basal fertilizer dose of 90-60-75 kg NPK ha^{-1} .All PK and ½ N was applied at the time of sowing and remaining ½ N was side dressed with second irrigation at the time of flowering. All the cultural practices were adopted in all the plots through out the growing period uniformly. Normal looking ten plants in each subplot was tagged and data on number of pods per plant, and seed yield Kg ha^{-1} were recorded. The data was subjected to analysis of variance by using computer programme M STAT-C. The treatment means were compared by Duncan`s new multiple range test Gomez and Gomez (1984).

RESULTS & DISCUSSION

Number of pods $plant^{-1}$

Table: 1. Presents the effect of treatments on the number of pods $plant^{-1}$ of *Brassica* species in both the seasons. The intermediate row spacing of 35 cm significantly increased the number of pods $plant^{-1}$ over 25 or 45 cm row spacing in both seasons. Similarly wider spacing of 45 cm also produced higher number of pods $plant^{-1}$ than the closer spacing of 25 cm. Plant spacing of 12 cm significantly enhanced the number of pods over 16 or 8 cm in both the seasons. In 2001-2002 differences in the number of pods between 12 cm and 16 cm were, however, statistically at par. In 2001-2002, the average number of pods $plant^{-1}$ was 368.48 at 8 cm, 401.86 at 12 cm and 398.05 pods at 16 cm plant spacing respectively. Equivalent figures in 2002-2003 were 402.95, 439.54 and 434.91 pods $plant^{-1}$. Overall average number of pods $plant^{-1}$ 389.46 and 425.82 in 2001-2002 and 2002-2003, respectively. Which are similar to those reported by Cheema *et al* (2001).

The variety Rainbow gave more number of pods plant-1(467.62) than indigenous Gaj (311.31) in 2001-2002. Similar trend was observed in 2002-2003. Equivalent values were 510.74 and 340.86.

The interaction between varieties x row spacing, varieties x plants spacing, row spacing x plant spacing and varieties x row spacing x plant spacing was found to be non significant in 2001-2002 and 2002-2003 except row spacing x plant spacing was found to be significant in 2002-2003 (Table :1).

Table: 1. Effect of row spacing and plant spacing on the number of pods per plant of Brassica species.

Treatment	Number of Pods Per Plant		Mean
	2001-002	2002-003	
Row spacing (R)			
25cm	351.20 b	388.45 b	369.83
35cm	461.71 a	497.24 a	479.48
45cm	355.49 b	391.76 b	373.63
LSD 5%	19.58	16.28	
Plant spacing (P)			
8cm	368.48 b	402.95 b	385.72
12cm	401.86 a	439.54 a	420.70
16cm	398.05 a	434.91 a	416.48
LSD 5%	19.58	16.28	
Varieties (V)			
V1	467.62	510.74	489.18
V2	311.31	340.86	326.09
Interaction			
V x R	NS	NS	
V x P	NS	NS	
R x P	NS	*	
V x R x P	NS	NS	

Means in the same column having different letters differ significantly at ($P \leq 0.05$)
* = at ($P \leq 0.05$) , ** at ($P \leq 0.01$) , NS = Non significant.

The interaction between row spacing x plant spacing (Table: 2) affecting number of pods per plant showed that treatment combination of R3P2 (16 cm x 12 cm) significantly gave more number of pods (506.35) plant^{-1} than all other treatments combinations.

The lowest number of pods plant^{-1} was given by R1P1 (25 cm x 8 cm) where the number of pods was 362.74 plant^{-1}.

Table: 2. The Interaction between row spacing x plant spacing affecting the number of pods per plant of Brassica species.

Treatment	Number of pods per Plant	
	2001-002	2002-003
R1P1	NS	362.74 d
R1P2		462.66 b
R1P3		383.47 cd
R2P1		391.00 c
R2P2		522.71 a
R2P3		404.91 c
R3P1		411.63 c
R3P2		506.35 a
R3P3		386.76 cd
LSD 5%	___	28.20

Means in the same column having different letters differ significantly at ($P \leq 0.05$)

Seed yield (kg ha^{-1})

Table: 3. Presents the seed yield as affected by the row and plant spacing in both the seasons. In 2001-2002 medium row spacing of 35 cm significantly increased the seed yield (1954.32 kg ha^{-1}) over 25 and 45 cm row spacing (1930.47 and 1783.15 kg ha^{-1}) respectively. In 2002-2003 a similar trend was noted, where, the equivalent value were 2041.05,1984.92 and 1814.35 kg ha^{-1} respectively

Plant spacing of 12 cm significantly increased the seed yield than the 8 or 16 cm plant spacing in both the seasons. Similarly the 12 cm plant spacing was also superior in seed yield

than the 16 cm plant spacing. In 2001-2002 medium plant spacing of 12 cm significantly increased the seed yield (1980.56 kg ha^{-1}) over 8 and 16 cm plant spacing (1902.96 and 1784.42 kg ha^{-1}) respectively. Overall average final seed yield was 1889.14 and 1946.78 kg ha^{-1} respectively, in 2001-2002 and 2002-2003. These results are in consonance of those reported by Hussain, et al(1991) and Nawaz, et al (1995).

Table: 3. Effect of row spacing and plant spacing on the seed yield kg ha^{-1} of Brassica species .

Treatment	Seed yield kg ha^{-1}		Mean
	2001-002	2002-003	
Row spacing (R)			
25cm	1930.47 b	1984.92 b	1957.70
35cm	1954.32 a	2041.05 a	1997.69
45cm	1783.15 c	1814.35 c	1798.75
LSD 5%	22.59	26.11	
Plant spacing (P)			
8cm	1902.96 b	1964.68 b	1933.82
12cm	1980.56 a	2066.10 a	2023.33
16cm	1784.42 c	1809.54 c	1796.98
LSD 5%	22.59	26.11	
Varieties (V)			
V1	2135.80	2223.57	2179.69
V2	1642.82	1670.08	1706.45
Interaction			
V x R	* *	* *	
V x P	* *	* *	
R x P	* *	* *	
V x R x P	* *	* *	

Means in the same column having different letters differ significantly at ($P \leq 0.05$)
* = at ($P \leq 0.05$) , ** at ($P \leq 0.01$) , NS = Non significant.

The Canola cv. Rainbow produce maximum seed yield kg ha^{-1} (2135.80) than indigenous cv. Gaj (1642.82 Kg ha^{-1}) in 2001-2002. A similar trend was noted in 2002-2003. (Table: 3).

Generally *Brassica sp.* Sown at narrow row spacing give higher seed yields than when sown in merely widely spaced rows. Many studies in Canada (Kondra, 1975), Denmark (Nordstagaard, 1979) and New Zealand (Sims, 1976) have demonstrated higher yields of rape seed with narrow row spacing.

The interaction between varieties x row spacing, varieties x plants spacing, row spacing x plant spacing and varieties x row spacing x plant spacing affecting seed yield Kg ha^{-1} was found to be highly significant in 2001-2002 and 2002-2003, (Table: 3).

The interaction between varieties x row spacing affecting seed yield Kg ha^{-1} (Table: 4) showed that treatment combination of R2V1 (35 cm x Rainbow) significantly produced maximum seed yield Kg ha^{-1} (2230.25) than all other treatments combinations. The lowest seed yield Kg ha^{-1} was given by R3V2 (25 cm x Gaj) where the seed yield was (1583.87 Kg ha^{-1}). A similar trend was noted in 2002-2003.

Table: 4. The Interaction between varieties x row spacing affecting seed yield kg ha^{-1} Brassica species.

Treatment	Seed yield kg ha^{-1}	
	2001-002	2002-003
R1V1	2194.73 b	2272.61 b
R2V1	2330.25 a	2346.60 a
R3V1	1982.39 c	2051.49 c
R1V2	1666.20 d	1697.23 e
R2V2	1678.40 d	1735.48 d
R3V2	1583.87 e	1577.54 f
LSD 5%	31.95	36.93

The interaction between varieties x plant spacing affecting seed yield Kg ha^{-1} (Table: 5) showed that treatment combination of P2V1 (12 cm x Rainbow) significantly produced maximum seed yield Kg ha^{-1} (2257.66) than all other treatments combinations. The lowest seed yield Kg ha^{-1} was given by P3V2 (16 cm x Gaj) where the seed yield was (1579.82 Kg ha^{-1}). A similar trend was noted in 2002-2003.

Table: 5. The interaction between varieties x plant spacing

affecting seed yield kg ha^{-1} Brassica species.

Treatment	Seed yield kg ha^{-1}	
	2001-002	2002-003
P1V1	2160.68 b	2245.54 b
P2V1	2257.66 a	2366.98 a
P3V1	1989.03 c	2057.84 c
P1V2	1645.20 e	1683.81e
P2V2	1704.45 d	1765.20 d
P3V2	1579.82 f	1561.23 f
LSD 5 %	31.95	36.93

Table: 6 The interaction between row spacing x plant spacing affecting seed yield kg ha^{-1} Brassica species.

Treatment	Seed yield kg ha^{-1}	
	2001-002	2002-003
R1P1	1932.21d	1984.74 d
R1P2	2028.70 b	2106.36 b
R1P3	1830.50 e	1863.67 e
R2P1	1976.29 c	2064.60 c
R2P2	2102.01 a	2236.15 a
R2P3	1784.67 g	1822.40 g
R3P1	1800.38 f	1844.71 f
R3P2	1810.97 f	1855.78 f
R3P3	1738.11 h	1742.56 h
LSD 5%	39.13	45.23

Means in the same column having different letters differ significantly at ($P \leq 0.05$)

The interaction between row spacing x plant spacing affecting seed yield Kg ha^{-1} (Table: 6) showed that treatment combination of R2P2 (35 cm x 12 cm) significantly produced maximum seed yield Kg ha^{-1} (2102.01 Kg ha^{-1}) than all other treatments combinations. The lowest seed yield Kg ha^{-1} was given by R3P3 (45 cm x 16 cm) where the seed yield was (1738.11 Kg ha^{-1}). A similar trend was noted in 2002-2003.

Table: 7. The interaction between varieties x row spacing x plant

spacing affecting seed yield kg ha^{-1} of Brassica species.

Treatment	Seed yield kg ha^{-1}	
	2001-002	**2002-003**
R1P1V1	2198.43 d	2272.28 d
R1P2V1	2322.96 b	2418.39 b
R1P3V1	2062.82 e	2127:16 e
R2P1V1	2252.39 c	2368.20 c
R2P2V1	2427.18 a	2591.92 a
R2P3V1	2011.19 f	2079.68 f
R3P1V1	2031.34 f	2096.14 f
R3P2V1	2022.86 f	2090.63 f
R3P3V1	1893.09 g	1966.70 g
R1P1V2	1666.00 k	1697.21 k
R1P2V2	1734.44 i	1794.32 i
R1P3V2	1598.17 *l*	1600.17 *l*
R2P1V2	1700.19 j	1760.97 j
R2P2V2	1776.85 h	1880.38 h
R2P3V2	1558.16 o	1565.10 o
R3P1V2	1569.42 n	1593.27 n
R3P2V2	1599.08 m	1620.92 m
R3P3V2	1583.13 p	1518.43 p
LDS 5 %	55.34	63.97

Means in the same column having different letters differ significantly at ($P \leq 0.05$)

The interaction between varieties x row spacing x plant spacing affecting seed yield Kg ha^{-1} (Table: 7) showed that treatment combination of R2P2V1 (35 cm x 12 cm x Rainbow) significantly produced maximum seed yield Kg ha^{-1} (2427.18 Kg ha^{-1}) than all other treatments combinations. The lowest seed yield Kg ha^{-1} was given by R3P3V2 (45 cm x 16 cm x Gaj) where the seed yield was (1583.13 Kg ha^{-1}). A similar trend was noted in 2002-2003.

The increase in seed yield under medium row (35 cm) and medium plant spacing (12 cm) over wider spacing may be ascribed to comparatively better plant growth resulting the improvement in yield components. The adequate spacing resulted in an optimum density and uniform distribution which probably utilized the resources more efficiently and thus more TDM was partitioned to seed yield. This substantiate the contention of Donald and Christensen *et al* (1984) who emphasized that final economic yield will increase with increase in biological yield.

The average seed yield of the present study at 1889.14 kg ha^{-1} (2001-2002) and 1946.78 kg ha^{-1} (2002-2003). The results of the present study are inconsonance with those reported by Ali *et al.* (1996), working in Bangladesh, reported slightly higher seed yield of > 2 t ha^{-1} under different plant populations. Thakuria and Gogoi (1996), reported lower seed yield of about < 1.0 t ha^{-1} in India. However, Bhan *et al.* (1995) reported 1.1 t in 10 cm and 1.2 t ha^{-1}v in 15 cm plant spacing, respectively. They also noted a decrease in seed yield at wider plant spacing, a result similar to that found in the present study.

Oil contents (%)

Table: 8 Presents the effect of treatments on oil contents during both the seasons. The wider row spacing of 45 cm significantly increased oil percentage compared with the 35 and 25 cm row spacing in both the seasons. Similarly row spacing of 35 cm also enhanced oil percentage over 25 cm row spacing in both the seasons in 2001-2002 average oil contents were 39.69 %. Similar trend was observed in 2002-2003. The equivalent values were 39.71 %.

TABLE: 8 Effect of row spacing and plant spacing on oil contents (%) of Brassica species.

Treatment	Oil Contents (%)		Mean
	2001-002	2002-003	
Row spacing (R)			
25cm	38.98 c	39.03 c	39.00
35cm	39.75 b	39.72 b	39.74
45cm	40.34 a	40.37 a	40.36
LSD 5%	0.4478	0.4938	0.4708
Plant spacing (P)			
8cm	38.62 c	38.66 c	38.64
12cm	39.72 b	39.81 b	39.77
16cm	40.73 a	40.65 a	40.69
LSD 5%	0.4478	0.4938	0.4708
Varieties (V)			
V1	40.17	40.23	40.20
V2	39.21	39.18	39.20
Interaction			
V x R	NS	NS	
V x P	NS	NS	
R x P	NS	NS	
V x R x P	NS	NS	

Means in the same column having different letters differ significantly at ($P \leq 0.05$)
* = at ($P \leq 0.05$), ** at ($P \leq 0.01$), NS = Non significant.

Plant spacing also significant influenced oil contents in both the seasons. The wider plant spacing of 16 cm enhanced oil contents by 40.73 % in 16 cm, 39.72, in 12 cm and 38.62 in 8 cm plant spacing in 2001-2002. Similar trend was observed in 2002-2003. Many workers have reported similar oil contents of about 40% in *Brassica* sp. (Scott *et al.*, 1973; Singh and Kumar, 1996; Cheema *et al.*, 2003).

The interaction between varieties x row spacing, varieties x plants spacing, row spacing x plant spacing and varieties x row spacing x plant spacing affecting seed oil content (%) was found to be non significant in 2001-2002 and 2002-2003, (Table 8).

LITERATURE CITED

Ali. M.H., S.M.H. Zaman and S.M.A. Hossain. 1996. Variation in yield, oil and protein content of rapeseed (*Brassica campestris*) in relation to levels of nitrogen, sulfur and plant density. Ind. J. Agron., 41(2):290-295.

Bhan. S. and A. Singh. 1995. Note on response of brown sarson to varying doses of NPK under dry land farming in Utar Pradesh. Ind. J. Agri. Res., 10(2):139-140.

Cheema, M. A., M. Saleem, and M. A. Malik. 2001. Effect of row spacing and nitrogen management of agronomic traits and oil quality of canola (*Brassica napus* L.). Pak. J. Agric. Sci. 38(3-4): 15-18.

Cheema, M. A., A. Ali., M. F. Saleem and M. Din. 2003. Interactive effect of nitrogen and sulphur on growth, seed yield and oil quality of canola. Pak. J. Life Soc. Sci., 1: 9-12.

Christensen, J.V. and J.C. Drabble. 1984. Effect of row spacing and seeding rate on rape seed yield in Nothwest Alberta. Can. J. Pl. Sei., 64(4):1011-1013(Field Crop Absts., 38(11):6729; 1985).

Gomez,A.K. and A.A.Gomez,1984. Statistical procedure for agricultural research,(2nd Ed.)Johns Willey and Sons, New York.

Hussain, A. and R.J. field. 1991. Effect of sowing date, plant population and planting method on the growth and dry matter yield of sugarbeet. Pak. J. Agri. Sci., 28:152-158.

Kondra, Z.P. 1975. Effects of row spacing and seeding rate on rapeseed. Canadian Journal of Plant Science, 55 (1):339-341. (Field Crop Absts., 28 (9):5942; 1975).

Nawaz, M.A. Hussian, F.M. Choudhry, M. Maqsood and M. azam. 1995. Effect of sowing date plant population on seed yield and yield components of chickpea. J. Agri. Res., 33:317-126.

Nordestgaard, A. 1979. Different sowing rates and row spacing for spring rape. Froskellige samaengder og raekkeafstande ved avl af varraps. Meddelelse, Statens Plnteavlsfors og., 81(1480):3 (Field Crop Absts., 33(11): 9003; 1980).

Scott, R.K., E.A. Ogunremi, J.D. Ivins and N.J. Mendham. 1973. the effect of fertilizers and harvest date on growth and yield of oil seed rape sown in autumn and spring. J. Agric. Sci., Camb. 81(60:287-293.

Sharma, M. I,. 1992.Response of mustard (Brassica juncea L.) varieties to row spacing. Indian Journal of Agronomy.,73(3):593-594[Field crop Absts.,46(12):8685.,1993].

Sims, R.E.H. 1976. Effect of planting pattern and sowing methods on the seed yield of safflower, oilseed rape and Lupin. N.Z. J. Exp. Agric. 4;185-189.

Singh, B. and V. Kumar. 1996. Response of Indian mustard (*Brassica juncea*) to nitrogen and sulfur application under rainfed condition. Ind. J. Agron., 41(2):286-280.

Thakuria, K. and P.K. Gogoi. 1996. Response of rainfed mustard (*Brassica juncea*) to nitrogen and row spacing. Indian J. Agron., 441(2):279-281.