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Influence of various levels of nitrogen, cultivars and weed control treatments on quality traits of canola *gobhi sarson* (*Brassica napus* L.)

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ABSTRACT : The field experiment was conducted to study the effect of various nitrogen levels, cultivars and weed control treatments on quality traits and smothering potential of canola gobhi sarson (*Brassica napus* L.) at Punjab Agricultural University, Ludhiana during the *Rabi* season of 2008-09. The experiment was conducted in split plot design and comprised of 16 treatment combinations *viz.*, four nitrogen levels as main plot treatments (100, 125, 150 and 175 kg N/ha), two cultivars (GSC 6 and Hyola PAC 401) and two weed control methods (weeded and unweeded control) as sub plot treatments, with three replications. The crop registered significantly higher seed yield, oil yield and protein content with the application of 125 kg N/ha, with further increase in nitrogen up to 150 and 175 kg N/ha the increase was non-significant. There was no difference in competitive ability of both cultivars and Hyola PAC 401 yielded higher because of its higher yield potential than GSC 6. Protein and oil content were inversely proportional with each other with increase in nitrogen level. Oil content decreased with increase in nitrogen level recording maximum value at 100 kg N/ha.

Key Words : *Brassica napus*, Canola, Gobhi sarson, Oil content, Protein content

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Oilseeds play vital role in Indian economy, accounting 5per cent of gross national product and 10 per cent of the value of the agricultural product. Rapeseed and mustard are second most important group of oilseed crops in India after groundnut and contribute a major share to the vegetable fat economy of the country. In India, during 2009-2010, these crops were grown in an area of 5.59 million hectare with a production of about 6.61 million tonnes, whereas in Punjab, the figures are 30 thousand hectare and 39 thousand tonnes, respectively (Anonymous, 2011). The per capita availability of edible oil in India is 7.6 kg per annum as against the requirement of world health organization as 11.0 kg per annum. It is estimated that nearly 60 million tonnes of total edible requirement would be required 2020 AD (Hedge, 2000). The low productivity of these crops under Indian sub-continent is in fact due to their cultivation on inherently low fertility soils with poor management practices. These are not grown as main crop in most of the area cultivated. Recommended fertilizers are not applied to the crop. So there is need to increase the yield of oilseeds. Rapeseed and mustards oil is of low quality due to the presence of high concentration of erucic acid and glucosinolates. Canola stands for Canadian Oil Low Acid. Canola (*Brassica napus* L.) is a genetically improved version of rapeseed and is low in both erucic acid and glucosinolates which distinguish it from ordinary rapeseed. Besides, it has the lowest level of saturated and highest level of mono and polyunsaturated fatty acids, which reduce cholesterol level. Therefore, canola is gaining more popularity among farmers. The standard requirements for an oil to be canola is that it has 2 per cent or less of Erucic acid of the total fatty acids and less than 30 micromoles/g of glucosinolates in the oil free meal. It is also called double zero ('00') crop and swede rape. Fertilizer management has an important role to play for increasing its productivity, which can be realised by providing plant nutrients in balance amount along with suitable agronomic package to the crop. So, the experiment was conducted with the objective to study the effect of nitrogen levels, cultivars and weed control methods on quality of canola *gobhi sarson.*

RESEARCH PROCEDURE

The present investigation entitled was carried out at the Students Research Farm, Department of Agronomy, Punjab Agricultural University, Ludhiana during the *Rabi* season of 2008-09. The soil was loamy sand, low in organic carbon (0.28%) and available N (243 kg N ha^{-1}), medium in available P (20.8 P ha^{-1}) and medium in available K (188 kg K ha^{-1}) with pH 8.1 and EC 0.19 dS m^{-1} at 25 ^oC. The experiment was laid out in split plot design with four nitrogen levels *i.e.* 100, 125, 150 and 175 kg N ha^{-1} in the main plots and four treatments of cultivars *i.e.* GSC 6, Hyola PAC 401 and weed control treatments *i.e.* weeded and unweeded in the subplots. Treatments were replicated thrice. The crop was sown on 24th October 2008. The crop was sown with hand drill, in rows 45 cm apart and seeds were covered with light soil by *jandra*. The plant to plant spacing of 10 cm was kept by thinning the crop. Fertilizers were applied as per treatments. Nitrogen was applied through urea (46% N) whereas phosphorus was applied through single super phosphate (16% P_2O_5) which is also source of sulphur (12% S). Hand weeding was done at 30 days after sowing (DAS) to the crop by using small hand tool *i.e. Khurpa*. The first post sowing irrigation to the crop was given at 30 days after sowing. Second irrigation was applied at 50 DAS of crop whereas third and last irrigation was given at 75 days after sowing of crop. All recommended plant protection measures were adopted. To protect the crop from aphids and cabbage caterpillar alternate sprays of insecticides namely thiodon 35 EC (endosulfan) @ 500 ml/acre was made at appropriate crop growth stages. The crop was harvested manually with sickles when colour of stems, branches and siliquae changed from green to light yellow or brown. The harvested crop was tied in bundles, labeled and kept for sun drying for few days. Threshing was done manually with sticks separately for each plot. The produce of each plot was thoroughly cleaned by proper winnowing**.** The entire produce from net plot was threshed, weighed and expressed as q ha^{-1}. Oil content in the seed was determined with nuclear magnetic resonance spectroscope (Newport Analyser Model MK IIIA) employing non destructive method of oil estimation in whole seed (Alexander *et al.*, 1967). To estimate the protein content of grain, N percentage of grain was determined by the modified Kjeldahl's method (Mckenzie and Wallace, 1964). Then to obtain the protein content, N percentage was multiplied by a constant (6.25). Harvest index was calculated with the formula:

Harvest index = (Economic yield / Biological yield) x 100

Statistical analysis of the data was done by using CPCS1 (Cheema and Singh, 1991), software developed by the Department of Mathematics and Statistics, PAU, Ludhiana.

RESEARCH ANALYSIS AND REASONING

It was observed that the seed yield increased with increase in nitrogen levels upto 175 kg N/ha (Table 1). Maximum seed yield of (20.78 q ha^{-1}) was obtained with the application of 175 kg N/ha, which was significantly higher than 100 kg N/ha application (17.71 q ha^{-1}), however it was statistically at par with 125 kg and 150 kg N/ha. The seed yield increased by 8.9, 15.0 and 17.3 percent with 125, 150 and 175 kg N/ha application over 100 kg N/ha. Nitrogen application increased seed yield and significant response was observed up to 125 kg/ha (Deol

Table 1 : Influence of various levels of nitrogen, cultivar and weed control treatment on productivity and on quality traits of canola *gobhi sarson*

Treatments	Seed yield (q ha^{-1})	Straw yield (q ha^{-1})	Harvest index (%)	Oil yield (q ha^{-1})	Oil content (%)	Protein content (%)
Nitrogen (kg/ha)						
100	17.71	45.3	28.5	7.31	41.32	17.77
125	19.29	47.2	30.5	7.92	41.08	18.80
150	20.37	55.4	27.4	8.31	40.78	19.73
175	20.78	60.9	26.5	8.42	40.50	20.42
C.D. (P=0.05)	1.534	8.98	NS	0.63	0.33	1.76
Cultivar						
GSC 6	18.87	47.3	29.2	7.72	39.21	18.89
Hyola PAC 401	20.21	57.1	27.3	8.27	42.63	19.47
C.D. (P=0.05)	0.703	6.06	NS	0.29	0.18	NS
Weed control						
Weeded	20.67	60.6	25.9	8.45	41.36	19.56
Unweeded	18.41	43.7	30.6	7.53	40.48	18.80
C.D. (P=0.05)	0.703	6.06	2.53	0.29	0.18	NS
Interactions	NS	NS	NS	NS	NS	NS

NS=Non-significant

and Mahey, 2005). On the other hand application of 175 kg N/ha harvested significantly higher straw yield (60.9 q ha^{-1}) over the levels of 100 kg and 125 kg N/ha which yielded 45.3 q ha-1 and 47.2 q ha^{-1}, respectively and statistically at par with that of 150 kg N/ha application (55.4 q ha^{-1}). Similar results were reported by Brar *et al.* (1998). The differences among harvest index at different nitrogen levels were non-significant. Although highest harvest index was recorded for 120 kg N/ha. The quality analysis revealed that application of 175 kg N/ha yielded maximum oil yield which was significantly higher than 100 kg N/ha but at par with 125 and 150 kg N/ha. It is evident from the data given in Table 1 that oil content decreased significantly with successive increment in nitrogen levels upto 175 kg N/ha except at 150 kg N/ha where it remained statistically at par. Highest oil content (41.32 %) was obtained at 100 kg N/ha, whereas lowest value was 40.50 per cent at 175 kg N/ha. The oil content decreased with increasing levels of nitrogen because with increasing levels of nitrogen, protein content increased (Salaria and Dhillon, 2003). The decrease in oil content with increase in level of nitrogen might be due to utilization of photosynthates in protein synthesis. A significant decrease in oil percentage of the canola and other oil seed crops with increasing nitrogen rates reflects the inverse relationship between oil concentration and seed protein content. Many workers have reported similar results in oil seed crops (Hocking *et al*., 1997 and Cheema *et al*., 2001). Oil yield depends on seed oil contents and seed yield of oil seed crop per unit area. The higher oil yield with increasing rate of N fertilizer application was probably due to their higher seed yield. Protein content is direct function of nitrogen applied to the crop. Protein content increased as higher doses of nitrogen were used. Significantly higher protein content was obtained with 175 kg N/ha over 100 kg N/ha but was at par with 150 and 125 kg N/ha (Table 1). Protein content recorded 14.91 per cent higher value at 175 kg N/ha over 100 kg N/ha application. The increase in seed protein content of canola with the application of N could be due to the fact that N is an integral part of protein. The increase in protein content with the increase in N rate confirmed the findings of Kutcher *et al.* (2005) who found that protein contents of canola increased significantly with the increasing N rates.

Among the cultivars, Hyola PAC 401 proved more competent cultivar which produced seed yield, straw yield, oil content and oil yield (20.21 q ha^{-1}, 57.1 q ha^{-1}, 42.63 per cent and 8.27 q ha^{-1}, respectively) which was significantly superior over GSC 6 (18.87 q ha^{-1}, 47.3 q ha^{-1}, 39.21 per cent and 7.72 q ha^{-1}, respectively). Hyola cultivar recorded 7.1 per cent higher seed yield over GSC 6 which is due to its higher yield potential. Kumar *et al.* (2002) and Lal *et al.* (2000) also reported similar results. The difference among harvest index of both the cultivars was found to be non-significant. The cultivar, Hyola PAC 401 recorded significantly higher oil yield and oil content over GSC 6. The protein content among varieties recorded non-significant differences. However, Hyola PAC 401 recorded more protein content as compared to GSC 6 which was due to its higher inherent capacity.

Among weed control treatments i.e. hand weeding and weedy check. Hand weeding produced significantly higher seed and straw yield (20.67 and 60.6 q ha^{-1}, respectively) as compared to unweeded control which resulted in lower harvest index of weeded plots. Seed yield was 12.28per cent higher for weeded plots as compared to unweeded control. The results are in conformity with results reported by Fathi *et al.* (2005) and Singh *et al.* (2001). The protein content was non-significant among these treatments. The weeded treatments recorded significantly higher values of oil content over unweeded control as weeds in the unweeded control plots posed higher competition which ultimately reflected in yield. All other interactions were found to be non-significant All other interaction effects were found to be non-significant.

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