

Impact of Different Potassium (K) Application on Oil Content of Brassica under Field Condition

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Abstract
Pakistan is confronting a chronic scarcity of domestic edible oil requirements and Brassica, a second largest contributor after cottonseed to the indigenous edible oil production, can play a vital role in saving the huge amount of hard earned foreign exchange of Pakistan. One of the major issues with brassica oil seed production is the water requirement of the brassica crop. To address the problem, field experiment was conducted to evaluate the effect of potassium and water stress levels on canola (Brassica napus) under field conditions. Seed weight (4.86 g), grain yield (2335.1 kg ha^{-1}), biological yield (8398.7 kg ha^{-1}) and harvest index (27.73 %) were recorded with increase in potassium level up to 120 kg ha^{-1} and with full irrigation. Maximum oil content (49.9%) were observed in the plants treated with full irrigation of 120 kg K ha^{-1}.
Keywords: Brassica, Potassium,Oil Content, Variety, Irrigation, Water Stress, Biological Yield, Hravest Index.

INTRODUCTION
Pakistan is suffering from deficit of edible oil, and to meet the domestic needs, it has to depend on imports, which requires huge amounts of hard earned foreign exchange. Total requirement of edible oil in Pakistan during year (2008-09) was 1946 (000 tons), however, produced only 665 (000 tons) from all indigenous oilseed sources (MINFAL, 2009-10). The climate of Pakistan is characterized as arid to semi-arid showing deficiency of water for potential crop production. It is estimated that 1/4th of total cultivated land of Pakistan (4.9 millions hectares) is drought prone (Khan and Qayyum, 1986). Although the canal system of Pakistan is ranked among the best ones of the world, however, still agriculture of Pakistan is solely dependent on rain (Government of Pakistan 2010). Likewise under irrigated conditions availability of water is not ensured for the whole year especially in winter season (October to April) after monsoon termination (Edrneades et al., 1989). Eventually the yield falls far below its potential. Water shortage is not only characteristic of arid and semi-arid climate, water availability is becoming increasingly limited for irrigated agriculture due to increased cropping intensity and diminishing resources of water.
The same studies were carried out to evaluated the effect of partial irrigation systems and K^+ fertilizer on granule yield, antioxidant enzymes and lipid per oxidation.Plants in water stress and K^+ levels revealed important variations in contrast to control treatments. Plants with advanced levels of K^+ illustrated high resistance to drought strain circumstances and higher yield and dry matter portion to harvest index. Drought stress directs to production of oxygen radicals, where results in augmented lipid per oxidation biomarker and oxidative stress in the sow (Soleimanzadeh et al.2010). There was a major pessimistic relationship between yield increment by K^+ levels and soil available K^+ concentration. With reference to yield of CK/K^+ at 90 percent level, the soil available K^+ serious level will be 135 mg kg^{-1} (Zou and Lu.2010).With rising stress severely grain yield reduced, except K^+ application awarded huge increase on rapeseed yield. K^+ Levels could improve negative effects of water stress on seed yield and physiological indicators and as a result improved them (Fanaei et al.2009). The effect of different levels of K^+ application (0, 25, 50, 75, 100, 125 and 150 kg ha^{-1}) on stages of growth, yield and oil contents of canola. Maximum seed yield (3472 kg ha^{-1}) retained with K^+ (150 kg ha^{-1}). It was yet, at par with other treatments where 50, 75, 100 and 125 kg K ha^{-1} were applied. Minimum seed yield (2586 kg ha^{-1}) was noted in controlled treatment. The oil level was gradually decreased with enhanced K^+ level and highest (42.85%) in control and minimum (37.41%) with 150 kg K ha^{-1}. Application of 125 kg K ha^{-1} is more economical than all other application levels (Khan et al. 2004), decreased of seed oil levels were observed because of raise in N, P, and K application. The high seed yield (3464 kg ha^{-1}) was observed when Canola crop was applied with fertilizer at the rate of 100-60-50 kg NPK ha^{-1} (Malik et al.2002).The influence of basal and foliar application of potassium on yield, nutrients absorption in tissue are excellent indicators of Groundnut. Major effect in yield through folear and soil application of Potassium with relation to the controlled level. The pods development was notably better where Basal and Foliar application was united. K^+ application enhanced the Crop Harvest Index and excellent indicators, proteins and oil levels. Further, response of K^+ in quality indicators, proteins and oil concentrations of seed were highly constant with Foliar application of K_2SO_4. (Umar et al.1999). Opposite relationship among the quantities of flavor compounds and Potassium supply may be utilized during produce practice to regain good flavor quality (Fischer.1992)

MATERIAL AND METHODS

The experimental site Khyber Pakhtunkhwa Agricultural University Peshawar is situated about 1700 km in the north of Indian Ocean at 34°N latitude, 72°E longitude and an altitude of 290 meters above sea level, in a field experiment at Malakandher Research Farm Khyber Pakhtunkhwa Agricultural University Peshawar using Randomized Complete Block design with split plot arrangement.

Field Experiment

The treatments of study were Irrigation Levels **of** I_1 with 100% replacement of ET_a, I_2 with 80 % replacement of ET_a and I_3 with 60 % replacement of ET_a. The Potassium (K) Levels K_1 with 60 kg ha^{-1} **,** K_2 with 90 kg ha^{-1} and K_3 with 120 kg ha^{-1} were apllied. The Brassica Varieties V_1 of Wester**,** V_2 of Rainbow,V_3 of Oscar and V_4 of Legend were grown.

Yield Parameters

Biological Yield

Biological yield was calculated by taking the weight of all plants in each treatment and then seed yield was subtracted from it and converted into $Kgha^{-1}$.

Grain Yield

Grain yield was calculated by threshing all pods of the plants in each treatment and then converted into grain yield $Kgha^{-1}$.

Harvest Index

The simple procedure of finding the index of harvest was used by division of total grain yield per hectare with total biological yield per hectare and multiplying with hundred. This method was used in each sub trail. Mathematically it can be written as:

$$HI = (GY/BY) * 100 \qquad \text{..........................}(1)$$

Where HI is Harvest Index (%), GY is Grain Yield (Kg ha^{-1}) and BY is Biological Yield (Kg ha^{-1})

Biochemical Traits

The qualitative and quantitative parameters of Oil content (%) was recorded from the produce of each treatment using Near Infra Red (NIR) Spectroscopy at oilseed laboratory, Nuclear Institute for Food and Agriculture (NIFA), Peshawar.

RESULTS AND DISCUSSION

Effect of Irrigation Levels on Oil Content

The data regarding to of oil content brassica varieties as affected by different levels of irrigation application is presented in Figure 3.1. The statistical analysis of the data indicated that irrigation (I)) had a strong significant ($P<0.05$) effect on oil content of brassica. The data revealed that maximum oil content of 49.9% was observed in those treatments where 100% irrigation level was applied while minimum oil content (41.1%) was produced in 60% irrigated treatments. It can be concluded that maximum oil content (49.9%) was produced by variety Legend (V4) when 100% irrigation level was applied while minimum oil content (29%) was retained by variety rainbow (V2) when treated with 60% irrigation level. These rsults nare similar to those found by Fanaei *et al*.(2009) that with rising stress severely grain yield reduced, except K^+ application awarded huge increase on rapeseed yield. It is clear that K^+ Levels could improve negative effects of water stress on seed yield and physiological indicators and as a result improved them (Fanaei et al.2009).

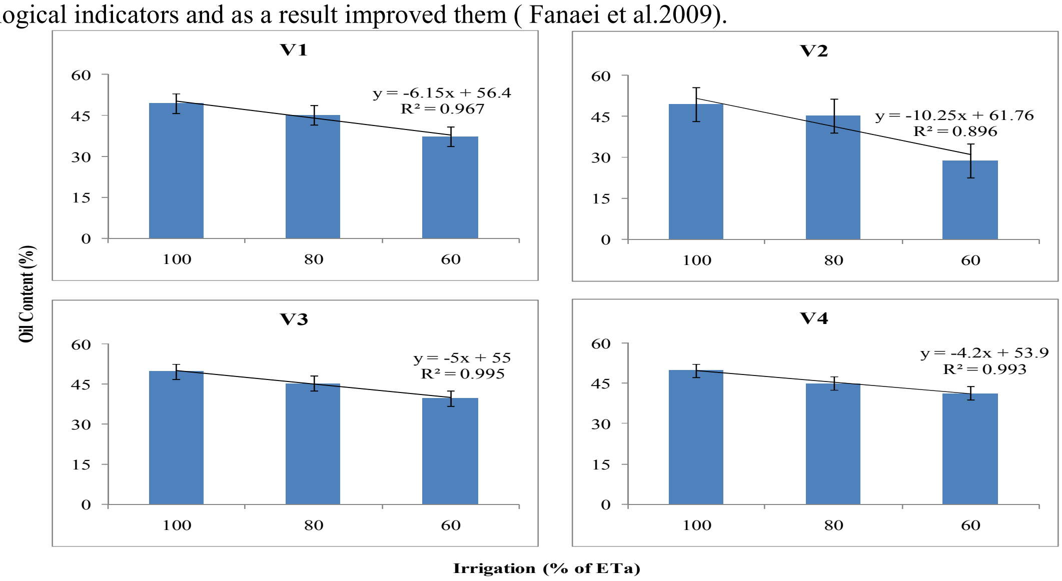

Figure 3.1 Effect of different levels of irrigation on oil content of brassica varieties.

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Effect of Potassium on Oil Content

The data about oil content of brassica varieties as affected by different levels of potassium application is shown in Figure 3.2. The statistical analysis of the data revealed that potassium application had also a highly significant ($P<0.05$) effect on oil content of brassica. The potassium application showed maximum oil content (45.6%) in plants treated with 120 kg K ha^{-1} and minimum oil content (42.4%) was noted in plants treated with 90 kg K ha^{-1}. The data presented in showed that maximum oil content (46.2%) was produced by variety Wester (V1) when treated with 120 kg K ha^{-1} and minimum oil content (40.1%) was given by variety Rainbow (V2) when treated with 60 kg K ha^{-1}. These results show similarity to those reported by Khan *et al.* (2004) that maximum seed yield (3472 kg ha^{-1}) was retained with K^+ (150 kg ha^{-1}). It was yet, at par with other treatments where 50, 75, 100 and 125 kg K ha^{-1} were applied. Minimum seed yield (2586 kg ha^{-1}) was noted in controlled treatment. The oil level was gradually decreased with enhanced K^+ level and highest (42.85%) in control and minimum (37.41%) was noted with 150 kg K ha^{-1}.

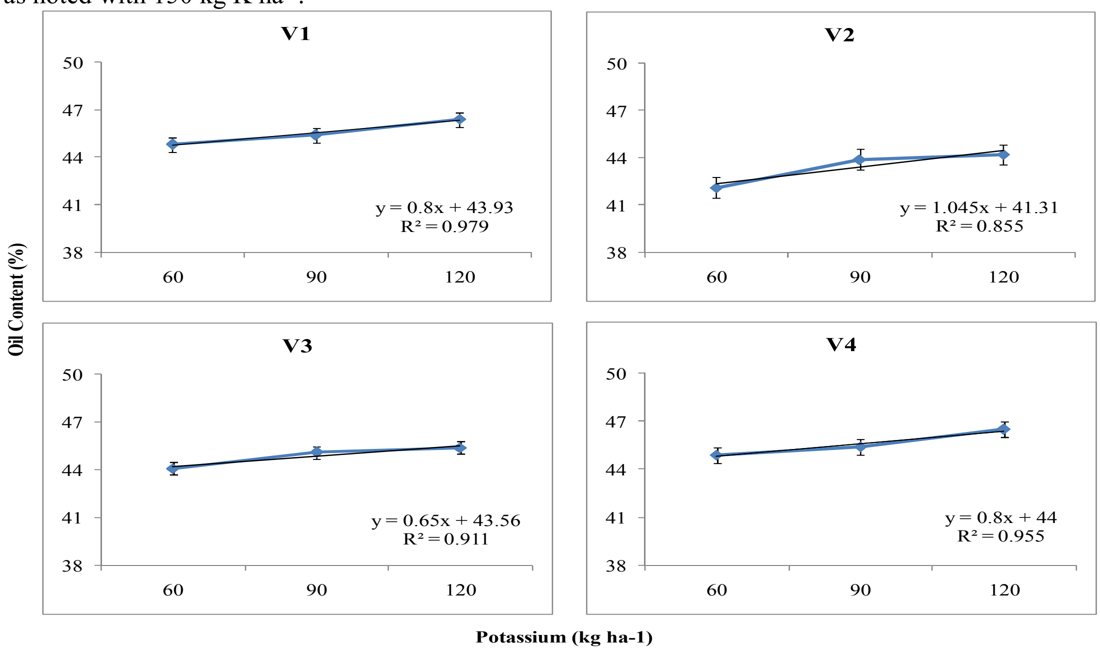

Figure 3.2 Effect of different levels of potassium (K^+) on oil content of brassica varieties.
V1 = Wester V2 = Rainbow V3 = Oscar V4 = Legend

Effect of Irrigation and Potassium on Oil Content

Figure 3.3 presents data regarding to oil content of brassica varieties as affected by different levels of I x K interaction. The analysis of the data indicated that I x K interaction had a high significant ($P<0.05$) effect on oil content of brassica. In case of I x K interaction, maximum oil content (49.9%) was noted in those plants which received 120 kg K ha^{-1} and 100% irrigation level and minimum (41.1%) was noted with 60 kg K ha^{-1} and 60% irrigation level. It can be observed from that maximum oil content (50.3%) was produced by variety Wester (V1) at 100% irrigation level and 120 kg K ha^{-1} while minimum oil content (40.08%) was also given by variety Wester (V1) when treated with 60 kg K ha^{-1} and 60% irrigation level.

CONCLUSIONS

Maximum oil content (49.9%) was produced by variety Legend (V4) when 100% irrigation level was applied while minimum oil content (29%) was retained by variety rainbow (V2) when treated with 60% irrigation level. maximum oil content (45.6%) in plants treated with 120 kg K ha^{-1} and minimum oil content (42.4%) was noted in plants treated with 90 kg K ha^{-1}. The data presented in showed that maximum oil content (46.2%) was produced by variety Wester (V1) when treated with 120 kg K ha^{-1} and minimum oil content (40.1%) was given by variety Rainbow (V2) when treated with 60 kg K ha^{-1}. maximum oil content (50.3%) was produced by variety Wester (V1) at 100% irrigation level and 120 kg K ha^{-1} while minimum oil content (40.08%) was also given by variety Wester (V1) when treated with 60 kg K ha^{-1} and 60% irrigation level.

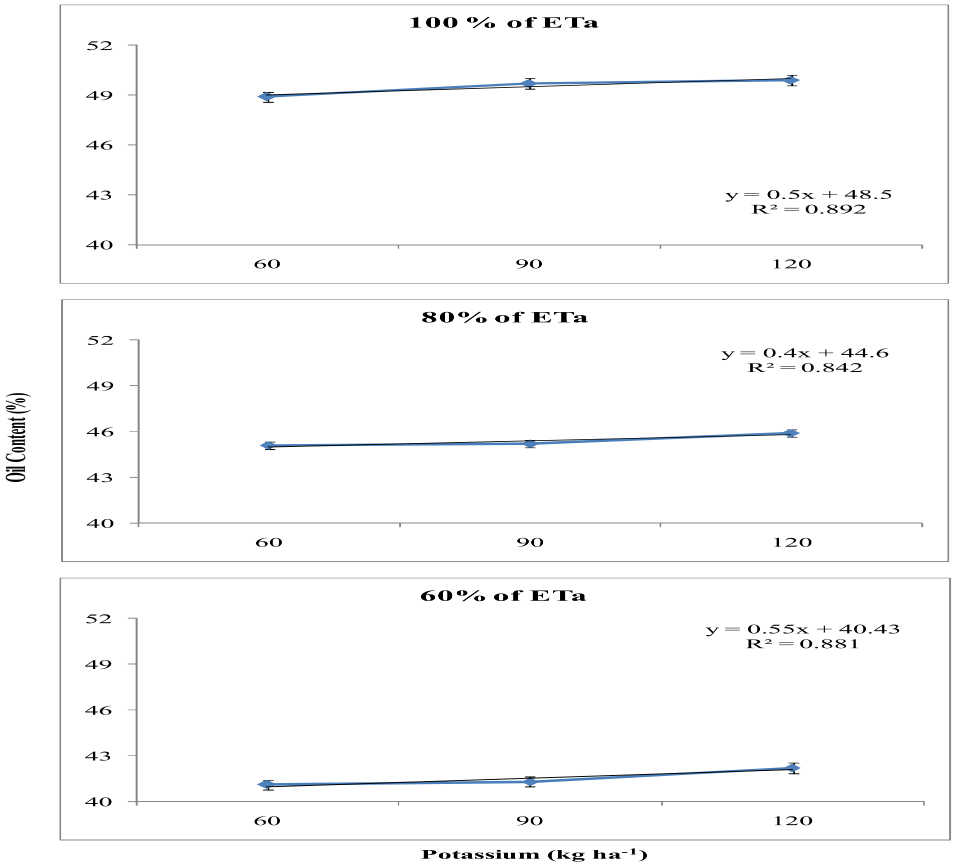

Figure 3.3: Effect of different levels of IxK on oil content of brassica varieties.

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