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# The Effect of Different Levels of Irrigation and Potassium (K) Application on Seed Erucic Content for Different Varieties of Brassica under Field Conditions

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**Abstract**
Field experiments were laid out in randomized complete block design (RCBD) with split plot arrangements at Malakandher Research Farm Khyber Pakhtunkhwa Agricultural University Peshawar Pakistan to study the effect of different levels of irrigation and potassium on seed Erucic Acid content of Brassica. Four varieties Wester, Rainbow, Oscar and Legend were selected on the basis of their good response to potassium application in water stress conditions.maximum erucic acid content (6.68%) was observed in treatments of 60% irrigation and minimum erucic acid content (4.67%) was observed in plants treated with 100% irrigation level.In case of potassium, maximum erucic acid content (5.66%) was noted in those treatments which received 120 kg K $ha^{-1}$ and minimum erucic acid content (5.45%) when treated with 90 kg K $ha^{-1}$. I x K interaction indicated maximum erucic acid content (6.79%) in plants treated with 60% irrigation level and 60 kg K $ha^{-1}$ while minimum erucic acid content (4.54%) was noted in plants treated with 60 kg K $ha^{-1}$ and 100% irrigation.
**Keywords:** Erucic Acid, Potassium, Irrigation, Stress, Brassica, Variety

## 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).Oilseed rape is an important source of vegetable oil and regarding world oilseed production it is now the second largest oilseed crop after soybean (FAO 2007). Rapeseed has gained acceptance worldwide largely because of major improvements in the seed oil and meal quality. World vegetable oil markets are highly competitive requiring a steady improvement in oil quality to increase market prospects. The objective of modifying oil quality is to develop oils with enhanced nutritional and functional properties and which require if possible no further processing for specific end-use markets. The market for rapeseed oil is primarily for human consumption, but also for a range of industrial applications (Craig and Millam 1995). Presently, different types of rapeseeds with a modified fatty acid composition are available for different purposes (Möllers 2004). In traditional *Brassica* oilseeds, the occurrence of erucic acid is considered as anti nutritional factor for human consumption. Therefore, it was minimized by breeding and finally developed Canola- or '00'-quality (Lühs and Friedt 1994, Przybylski and Mag 2002). High Erucic Acid Rapeseed (HEAR) cultivars are regaining interest for industries. Plants can avoid drought through increased water uptake, and/or decreased water loss. Increase in water uptake could be made through the development of extensive viable rooting system in response to drought in order to explore deeper soil layers for water (Oregan et al., 1993). Potassium (K) is an essential nutrient required for plant growth and reproduction. It is very important to many plant processes. Its role involves accepting the basic biochemical physiological systems of plants. Potassium does not develop into a part of chemical structure of plants. It plays numerous significant roles in development. It reduces water loss, uphold turgor, activates countless enzyme systems, increases root enlargement and improves water stress resistance, decreases respiration, prevents energy losses, helps in photosynthesis and food creation, improve translocation of sugars and starch, generate grain loaded in starch, add to protein content of flora, put up cellulose and decrease lodging and retard crop diseases (Zheng Shengxian, 1998).

## 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. Field experiments at Malakandher Research Farm Khyber Pakhtunkhwa Agricultural University Peshawar using Randomized Complete Block design with split plot arrangement. The treatments studied during the study at irrigation level of $I_1$(100% ), $I_2$ (80 %) and $I_3$( 60 %) replacement of $ET_a$. Potassium (K) Levels were $K_1$ (60 kg $ha^{-1}$), $K_2$ (90 kg $ha^{-1}$) and $K_3$ (120 kg $ha^{-1}$) where as brassica varieties were Wester ($V_1$), Rainbow($V_2$), Oscar ($V_3$) and Legend ($V_4$). The time of irrigation required to obtain the desired depth of irrigation for each treatment was calculated by using the equation according to James (1993). 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.

 

Different qualitative and quantitative parameters Erucic 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. Data was analyzed according to randomized complete block (RCB) design with split plot arrangements using ANOVA (Gomez and Gomez, 1984).

## RESULTS AND DISCUSSION

### Effect of Irrigation on Erucic Acid Content

The data pertaining to erucic acid content of brassica varieties as affected by different levels of irrigation application is presented in Figure 1 Statistical analysis of the data revealed that irrigation (I) application had a high significant ($P<0.05$) effect on erucic acid content of brassica. The data showed that maximum erucic acid content (6.68%) was observed in treatments of 60% irrigation and minimum erucic acid content (4.67%) was observed in plants treated with 100% irrigation level. Maximum erucic acid content (6.96%) was produced by variety Rainbow (V2) when treated with 60% irrigation level while minimum erucic acid content (4.29%) was resulted by variety Oscar (V3) when treated with 100% irrigation level. Bouchereau et al. (1996) reported that water stress, during the flowering stage, affected the oil concentration and fatty acid composition of canola seeds. Similar to the results of this experiment, drought stress conditions decreased the seed linolenic acid contents, but increased the glucosinolate and stearic acid contents (Moghadam et al., 2009). A decrease in the concentration of oleic, linolenic and erucic acid in response to drought stress has been reported in Sunflower kernels (Esmaeilian et al., 2012).

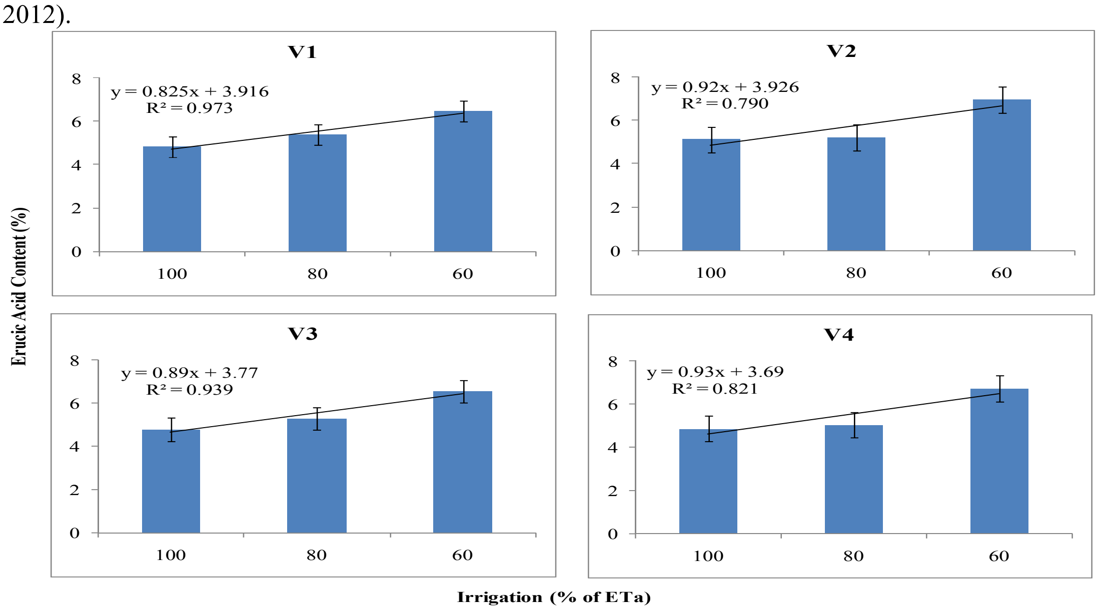


Figure 1: Effect of different levels of irrigation on Erucic acid content of brassica varieties.

### Effect of Potassium on Erucic Acid Content

The data on erucic acid content of brassica varieties as affected by different levels of potassium application is shown in Figure 2. The statistical analysis of the data revealed that potassium application had also a strong significant ($P<0.05$) effect on erucic acid content of brassica. In case of potassium, maximum erucic acid content (5.66%) was noted in those treatments which received 120 kg K $ha^{-1}$ and minimum erucic acid content (5.45%) when treated with 90 kg K $ha^{-1}$. Maximum erucic acid content (6.31%) was produced by variety Legend (V4) when applied with 120 kg K $ha^{-1}$ and minimum erucic acid content (4.63%) was given by variety Oscar (V3) when treated with 90 kg K $ha^{-1}$. Figure 4.32c presents data regarding to erucic acid content of brassica varieties as affected by different levels of I x K interaction. Akbari et al. (2011) also reported that oleic acid content of sunflower seeds was higher due to application of manure alone than its combination with chemical fertilizer or control. Thus the results of this experiment indicating an increase in the three fatty acids in brassica seeds in response to fertilizer application under both irrigated and drought stress conditions agree with the previous reports.

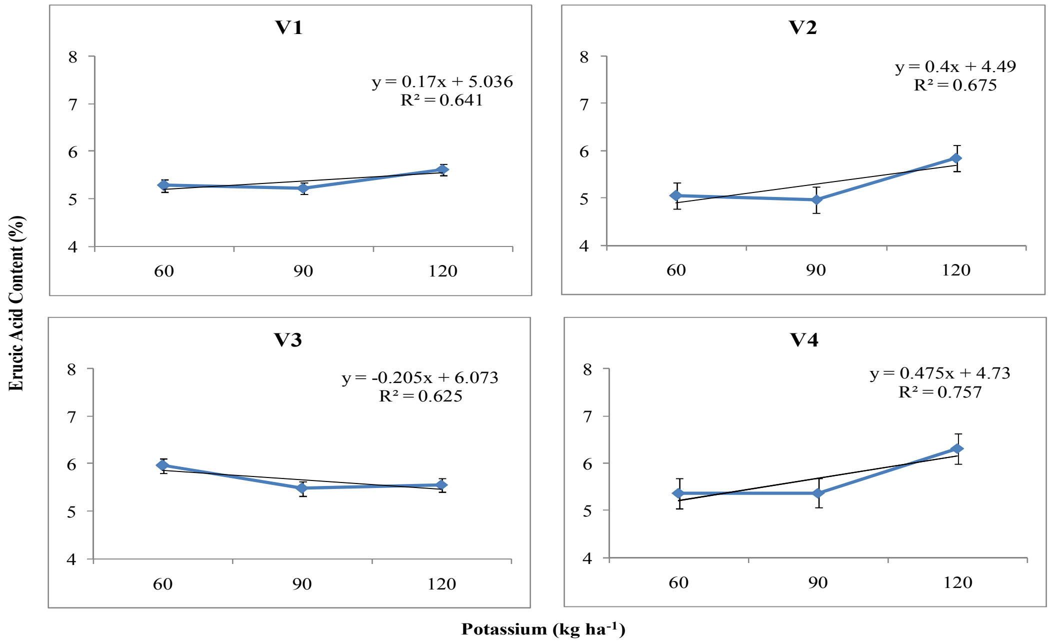


Figure 2: Effect of different levels of potassium (K) on Erucic acid content of brassica varieties.
V1 = Wester V2 = Rainbow V3 = Oscar V4 = Legend

**Comparison of Potassium and Irrigation with Erucic Acid Content**

The analysis of the data indicated that I x K interaction had a highly significant ($P<0.05$) effect on erucic acid content of brassica. I x K interaction indicated maximum erucic acid content (6.79%) in plants treated with 60% irrigation level and 60 kg K $ha^{-1}$ while minimum erucic acid content (4.54%) was noted in plants treated with 60 kg K $ha^{-1}$ and 100% irrigation. Maximum erucic acid content (17.65%) was produced by variety Oscar (V3) when treated with 60% irrigation level and 60 kg K $ha^{-1}$ while minimum erucic acid content (4.16%) was given by variety Wester (V1) at 60 kg K $ha^{-1}$ and 100% irrigation level.

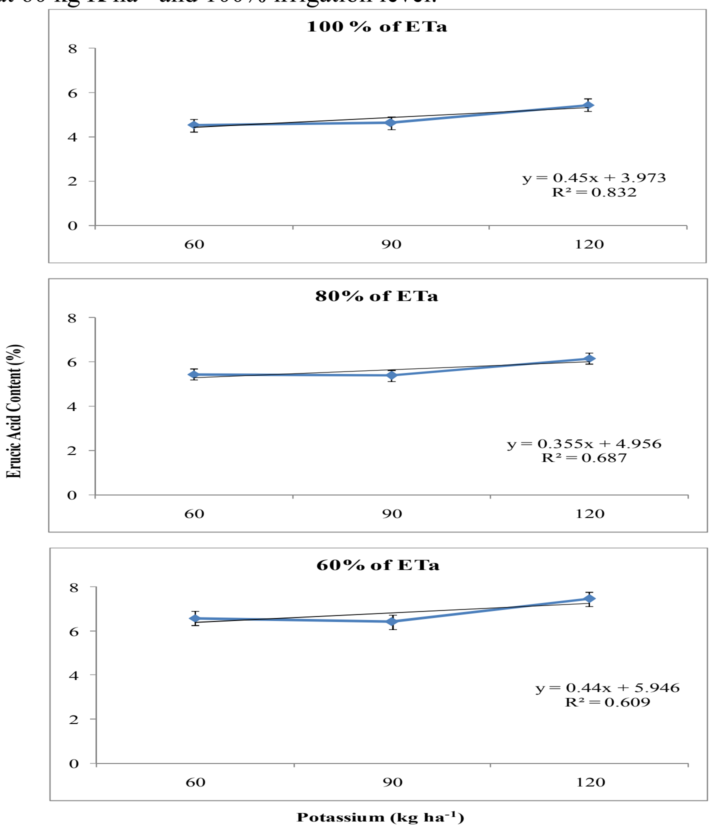


Figure 3: Effect of different levels of IxK on Erucic acid content of brassica varieties.

## CONCLUSION

Erucic acid content (6.79%) in plants treated with 60% irrigation level and 60 kg K $ha^{-1}$ while minimum erucic acid content (4.54%) was noted in plants treated with 60 kg K $ha^{-1}$ and 100% irrigation. In case of potassium, maximum erucic acid content (5.66%) was noted in those treatments which received 120 kg K $ha^{-1}$ and minimum erucic acid content (5.45%) when treated with 90 kg K $ha^{-1}$. Maximum erucic acid content (6.68%) was observed in treatments of 60% irrigation and minimum erucic acid content (4.67%) was observed in plants treated with 100% irrigation level.

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