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Delkhosh B., Shirani-e-Rad A.

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# RELATIONSHIP OF WATER USE WITH BIOPHISICAL AND YIELD PARAMETERS UNDER VARIOUS IRRIGATION LEVELS IN RAPESEED CULTIVARS

**B. Delkhosh * and A. Shirani-e-Rad ****
* Ph.D student and member of Science & Research Branch, Islamic Azad University. Tehran-Iran.
Babak_del80@yahoo.com
Mail Address: Iran-Tehran, Pounak Square, The end of Ashrafi-E-esfahani Freeway.
Islamic Azad University, Science& Research Branch. Agricultural collage, Agronomy Department.
** Seed and Plant improvement Institute, Karaj-Iran.

**SUMMARY** - Water is the most limitation factor in agricultural productions of the word. Research on drought and opportune water use is too important for water saving and high yield product. On time water use may also induce high biomass production, involving economic and environmental costs for moving and disposal of grass clippings. Also Rapeseed cultivars have a different and good tolerance to water deficit. Therefore, In Kraj-Iran, (35° 59´ N, 50° 75´ E), three irrigation levels were applied to a ***Brassica napus*** L. cv. Rebel turf from 2004/05.Treatments were equal to 50, 80, 110 of ETm (maximum evaporation) as main factors, and cultivars: Hyola401, Hyola308, 19-H, Heros, Hyola420 were as sub factors. Metacistocsis pesticide rate was 1.5 lit/ha use for pests' control, fertilizers used on basis of recommended Biological yield, Grain yield, Harvest Index, pod length, shrub height, Oil percent and number of pod measured. Results showed that no significant different between 50 and 80 ETm on all of the measured characters. But Hyola401 with 4320 Kg/ha grain yield and Harvest Index (%26.61) was the best cultivar in the water deficit condition. Also Heros had maximum Oil percent without significant different, and Hyola420 had maximum shrub length (140.5 cm) in this condition. Grain yield, Biological yield, Harvest Index and shrub length were significant different between 80 and 110 ETm in the cultivars. Result showed that Hyola308 had minimum grain yield (2925.2 Kg/ha) and Oil percent (%40.30) under 110 ETm, also 19-H, Heros c.v with 3125 and 3050 produced maximum Grain yield in this condition respectively. However results showed that with 30% water saving May could produce maximum Grain yield and Oil percent without significant different with Hyola401 cultivar of ***Brassica napus*** L. and also in 110 ETm condition; 19-H, Heros c.v recommended for planting to best economic and water saving result.

**Key words**: Water, Rapeseed *(Brassica napus* L.), Yield

## INTRODUCTION

One third of the world lands are classified as Arid and Semiarid Region and the remains are faced with water seasonal or local fluctuations (Beweley, and. Krochko.1982). Aridity is the most common environmental stress and approximately include 25% of the world lands (Christianse, 1982).

Among the most important criteria for genotypes assessment to environmental conditions is study of respective effect of genotype and resistant study of grain operation through non-considerable changes in different environmental conditions. Drought Stress may be due to number of physiologic activity including:

Evaporation, photosynthesis, organs and tissues length increasing or cell enzyme activities or cause for its stopping which in addition to intensive of stress and its duration, plant growth period in which plant faced with stress, also is an important factor for effect on growth and operation of plant (Macpheroson *et al.* 1987).

In initial growth period, initial germinates decrease. In general speaking, effect of drought stress except in sever stage on grain operation has less effect on total plant growth (Munoz and Fernandez. 1987).

Amount and velocity transfer of assimilates including plant photosynthesis is depends on plant reverse action and absorption of environmental stimulus, enzyme-hormone and avandi system operation and respective effects of these factors appeared in form of grain filling and velocity and have key role in grain resistance operation (DuDaka and Gayianas, 1991). It is apparent that water stress has no considerable effect on grain quality but in flowering time cause for decrease in grain oil contents (Wilcox. and frankenberyer.1987).

Under drought stress and in stomata , evaporation causes for decrease of photosynthesis and as a result WUE increase; but sever stress cause for complete closing of stomata and decrease of WUE due to lowering of photosynthesis (Huax *et al.*1997). Also it is clear that for preserve of product in rigid areas, knowing relation of type of root and resistance against drought stress is very important (Nielsen. 1997).

Meteorological features including precipitation effect, humidity, temperature and evaporation rate along with soil physicochemical conditions, type and features of cultivated plans and management operation in water uptake are interfere with plant (Mendham, *et al.* 1984). Recently, *Brassica napus* L. due to conformity with major regions of the country in lieu of seed production increase(Bates, *et al.*1973), also was taken into consideration for edible oils and its area of cultivation reach to 19,000 hectare in the year 2000.Colza that named also Canola is one of the most important world oil (Huax*et al.* 1997). Recently, resistance increase against drought and salt have been taken under importance of farmers and specialists and Canola has capability for conformity up to high extend limits.

Major part of Canola production in the world are under dry farming conditions and as a result, plant reaction to stress is an important topic (Mayers, *et al.* 1997). Canola may treated by dry farming in those regions which have autumn and spring raining. The plant has no need extra water , but in germination stage, Rosset period, stem elongation, flowering, seed formation and its growth; there is sense of water requirements (Singh et al, 1977). Canola is sensitive to drought in time of germination and pod grow. The case being most important when sufficient water is available for commencement of germination and new planted seedling faced with in -sufficiency water. Of course, in Canola cultivation water irrigation may not be used (Mayers, 19976).

Sims reported that Canola operation in Montana is use through use of water, but increase of water cause for mean decrease of oil (Sims, *et al.* 1993). Through performed tests under control conditions in France with Spring Canola, it was apparent that seed development stage is sensitive stage for growth of spring Canola for water stress. If water was insufficient in water, number of grain in pod may decrease and it is natural to increase for grain weight but there is no possibility for operation loss (Nakashima, et al 1998). Due to long period of flowering in farm, grain weight and number of grains up to considerable rate will determine in flowering stage.

*B.napus* has considerable resistance against aridity which is due to different features including: Root/shoot position; more distribution of plant in comparison with grains and pods after pollination between and inside Canola, specially *B.napus* as a considerable variance with regard to resistance against aridity such as: Proline accumulation; chlorophyll resistance, and more germination in water stress conditions (Mendham, and Scott. 1975).

Resistance of the plant for water absorption from depth of ground and its no requirements to rain water in drought region is a considerable advantages (Huax and Verbragen, 1997.). Canola can collect water even from 165cm depth, but 92-95% of consume water collect from profile upper 199cm(Nielsen, 1997). In *B.napus*, it is obvious that, generation of short roots tuber under drought conditions are a confront mechanism (Mendham and Jarosz, 1990). Canola water requirements is same as wheat. In autumn, due to relative dry of land, supplying sufficient humidity for seed germination has considerable importance. Whereas most raining of the province are occur in Autumn, Winter and beginning of the spring; autumn Canola may benefit from humidity of these seasons and has no need to valuable water in summer (Mendham, *et al.* 1981).

Also Canola with use of the remain soil humidity can produce good product in such a conditions that a little raining occur in planting stage and advanced period of plantlet and flowering time (Beweley and Krochko.1982).

Irrigation performance after 50 mm evaporation of Class A in Canola is produce the most grain operation and with increase irrigation period to 100 and 150 mm evaporation of class A, grain operation show meaningful decrease (Shirani-e-Rad, 2002). After Irrigation with 50 mm evaporation in control Class A in Canola, the most production of grain operation is attain and with increase of irrigation to 80 mm evaporation of Class A, grain operation is not receive meaningful decrease but in irrigation of 110 mm of class A; shown meaningful decrease of grain operation regarding control sample (Shirani-e-Rad, 2002). Whereas most part of consumable oil of the company are import from foreign countries, also due to limitations of water resources, the necessity of planting oil seeds have an important features.

## MATERIALS AND METHODS

For study of water stress effect on some agronomy and physiological characteristics of Canola figures; 5 spring Canola figures were planted in Karaj in Autumn 2004/05. The test was carried out in Seed & Plant Improvement Institute in latitude 50 and 75 east and longitude 35 and 59 north with mean raining fall of 243 mm.

Test were performed on split plot of Complete Random Block in four replication in which irrigation are carried out in three levels: 50, 80, 110 of ETm (maximum evaporation) as main factors of Class A, and sub factor in 5 levels including : Hyola401, Hyola308, 19-H, Heros and Hyola420 C.V.

Each test plot include 4 lines, each 5 meters with line distance of 30 cm and bush distance from line was 5 cm of which 2 adjacent lines were taken into consideration as effect.

Metacistocsis pesticide rate was 1.5 lit/ha use for pests' control, fertilizers used on basis of recommended Biological yield, Grain yield, Harvest Index, pod length, shrub height, Oil percent and number of pod measured.

For determination of features including number of, pod length, shrub height, and number of pod, 5 bush accidentally selected from each plot and then measured.

For Biologic yield, after bedding of each probation plot and before separation of grain from pod, total weight of bush were calculated and biologic yield of each hectare was determined. Also after separation of grains from pod, grain yield was determined and harvest index was identified through dividing grain yield on biologic operation .After determination oil percentage of each probation test in each hectare, oil grain yield was determined through multiple in grain yield.

Variances analysis did with MSTATc program at 5% level, and comparison of means did with Douncan's multiply exam.

## RESULTS AND DISCUSSION

Analysis of variance *(Table1)* show that no significant different between biological yield, grain yield, harvest index, high of plant, oil percent and number of pod in cultivars.

Hyola401 and Hyola308 had maximum and minimum biological and grain yield respectively that didn't have significant different to other cultivars. Also 19-H with 26.52 had maximum harvest index in cultivars *(Table 2)*.

Heros and Hyola401 with 48.9 and 174.5 oil percent and also numbers of pod product maximum these characters respectively. Major part of Canola production in the world are under dry farming conditions and as a result, plant reaction to stress is an important topic (Mayers, *et al.*1997). Canola may treated by dry farming in those regions which have autumn and spring raining. The plant has no need extra water , but in germination stage, Rosset period, stem elongation, flowering, seed formation and its growth; there is sense of water requirements (Singh et al, 1977). Canola is sensitive to drought in time of germination and pod grows.

Table1. Variance analysis of characters under study

| S.O.V | df | Biological Yield (Kg/ha) | Grain Yield (Kg/ha) | Harvest Index (%) | Pod length (cm) | High of Plant (cm) | Oil percent (%) | Pod numbers |
|---|---|---|---|---|---|---|---|---|
| **Replication** | **2** | 99479.34** | 1374.72$^{n.s}$ | 1.87$^{n.s}$ | 0.108$^{n.s}$ | 24.78$^{n.s}$ | 2.16$^{n.s}$ | 2.65$^{n.s}$ |
| **Irrigation** | **2** | 11589309.13** | 5871803.9** | 34.28** | 13.31** | 1323.68** | 152.27** | 3235.91** |
| **Error a** | **4** | 22414.10 | 17544.85** | 2.73 | 0.11 | 61.44 | 0.766 | 26.56 |
| **Cultivar** | **4** | 433973.19$^{n.s}$ | 107388.18$^{n.s}$ | 4.07$^{n.s}$ | 0.35* | 39.89** | 2.66$^{n.s}$ | 72.25** |
| **Irrigation. Cultivars** | **8** | 3259431.14** | 722338.76** | 1.74** | 0.14* | 10.38* | 0.256* | 23.35* |
| **Error b** | **24** | 91925.09 | 25748.19 | 1.86 | 0.22 | 12.24 | 1.35 | 22.32 |
| **Total** | **44** | | | | | | | |
| **C.V** | | 14.15 | 10.51 | 6.31 | 8.84 | 9.35 | 5.10 | 13.10 |

n.s = non significant different,
* = Significant different at 5% level,
** = Significant different at 1% level

Table 2. Cultivars effect on characters under study

| Cultivar | Biological Yield (Kg/ha) | Grain Yield (Kg/ha) | Harvest Index (%) | Pod length (cm) | High of Plant (cm) | Oil percent (%) | Pod numbers |
|---|---|---|---|---|---|---|---|
| **Hyola401** | A 13956.2 | A 3689.1 | A 26.12 | B 5.76 | B 136.1 | A 47.4 | A 174.5 |
| **Hyola308** | A 13521.18 | A 3052.8 | Ab 22.56 | A 6.3 | B 124.2 | Ab 46.9 | Cd 156.1 |
| **19-H** | A 13668.36 | A 3625 | A 26.52 | Bc 5.5 | D 111.9 | Ab 46.6 | Cd 152 |
| **Heros** | A 13854.28 | A 3591 | A 25.90 | B 5.7 | Bc 12939 | A 48.9 | Ab 165.5 |
| **Hyola420** | A 13799.86 | A 3602 | A 26.1 | Ab 6.1 | A 140.5 | Ab 47.3 | Bcd 160.1 |

Table 3. Interaction effects of Irrigation Cultivar

| | Biological Yield (Kg/ha) | Biological Yield (Kg/ha) | Biological Yield (Kg/ha) | Grain Yield (Kg/ha) | Grain Yield (Kg/ha) | Grain Yield (Kg/ha) |
|---|---|---|---|---|---|---|
| **Irrigation / Cultivar** | 50 ET | 80 ET | 110 ET | 50 ET | 80 ET | 110 ET |
| **Hyola401** | Ab 16479 | Ab 16234 | C 12425 | Ab 4310 | Ab 4320 | Cd 3030 |
| **Hyola308** | A 16505.5 | Ab 16037.7 | Bc 13401 | Ab 4440 | Ab 4250 | Cde 2925.2 |
| **19-H** | Ab 15992.6 | Ab 16293.4 | Bc 13925 | Ab 4350 | Ab 4220 | C 3125 |
| **Heros** | Ab 15709.7 | Ab 15428.5 | Bc 13120 | Ab 4090 | Ab 4050 | Cd 3050 |
| **Hyola420** | A 16511.1 | Ab 15613 | C 12210 | Ab 4425 | Ab 4125 | Cd 2991.6 |

| | Harvest Index (%) | Harvest Index (%) | Harvest Index (%) | Pod length (cm) | Pod length (cm) | Pod length (cm) | High of Plant (cm) | High of Plant (cm) | High of Plant (cm) |
|---|---|---|---|---|---|---|---|---|---|
| Irrigation / Cultivar | 50 ET | 80 ET | 110 ET | 50 ET | 80 ET | 110 ET | 50 ET | 80 ET | 110 ET |
| **Hyola401** | Ab 26.1 | Ab 26.6 | Bc 24.38 | Ab 7.9 | Ab 7.6 | Cd 4.4 | Ab 139.2 | Ab 132.1 | Bc 126.6 |
| **Hyola308** | Ab 26.9 | Ab 26.5 | Cd 21.82 | Ab 7.6 | Ab 7.1 | Cde 3.9 | Ab 136.1 | Ab 133.9 | Cd 120.1 |
| **19-H** | A 27.2 | Ab 25.9 | C 22.44 | Ab 8.1 | A 8.4 | De 3.9 | Ab 139.2 | Ab 136.5 | C 124.3 |
| **Heros** | Ab 26.6 | Ab 26.25 | Bc 23.32 | Ab 7.5 | Ab 7.3 | Cd 4.5 | Ab 136.0 | Ab 133.8 | Ab 130.3 |
| **Hyola420** | Ab 26.8 | Ab 26.42 | Bc 24.50 | Ab 7.7 | Ab 7.4 | Cd 4.5 | A 140.2 | A 140.5 | Ab 136.6 |

| | Oil percent (%) | Oil percent (%) | Oil percent (%) | Pod numbers | Pod numbers | Pod numbers |
|---|---|---|---|---|---|---|
| Irrigation / Cultivar | 50 ET | 80 ET | 110 ET | 50 ET | 80 ET | 110 ET |
| **Hyola401** | Ab 46.50 | Ab 47.20 | Bc 45.10 | Ab 162.9 | A 165.1 | Efg 126.6 |
| **Hyola308** | Ab 47.60 | A 48.10 | de 40.30 | Ab 160.1 | Ab 162.2 | De 134.5 |
| **19-H** | Ab 47.50 | Ab 47.00 | cde 42.60 | Ab 159.1 | Ab 162.2 | Ab 161.5 |
| **Heros** | A 48.10 | A 48.81 | Bcd 44.30 | A 164.2 | Ab 163.3 | Cde 152.2 |
| **Hyola420** | A 47.90 | Ab 47.30 | Bc 45.11 | Ab 163.6 | Ab 162.0 | Defg 127.9 |

The case being most important when sufficient water is available for commencement of germination and new planted seedling faced with in -sufficiency water. Of course, in Canola cultivation water irrigation may not be used (Mayers, and 19976).

Interaction effect *(Table 3)* showed that no significant different at biological yield, grain yield, harvest index, pod length high of plant, oil percent and numbers of pod in plant between 50 and 80 percent of Evaporation. Maximum G.Y belonged to Hyola420 at 50% ET (4425 Kg/ha), that didn't have significant different with Hyola401 with 4320 Kg/ha. Then we can produce maximum grain yield without significant different and with 30% water saving with Hyola401 c.v.

Alyari believes that, since most rainfall in Iran are in autumn, winter and beginning of spring; autumn Canola can use from these humidity and has no need to valuable water of summer (1). Also the plant has considerable capability for water absorption from ground depth without need to rain water even in drought lands that known as an advantages (8).

Also maximum harvest index at 80% ET belonged to Hyola401 (26.61%) that didn't has significant different with 19_H (27.2), but minimum of its belonged to 110 ET and Hyola308 c.v.

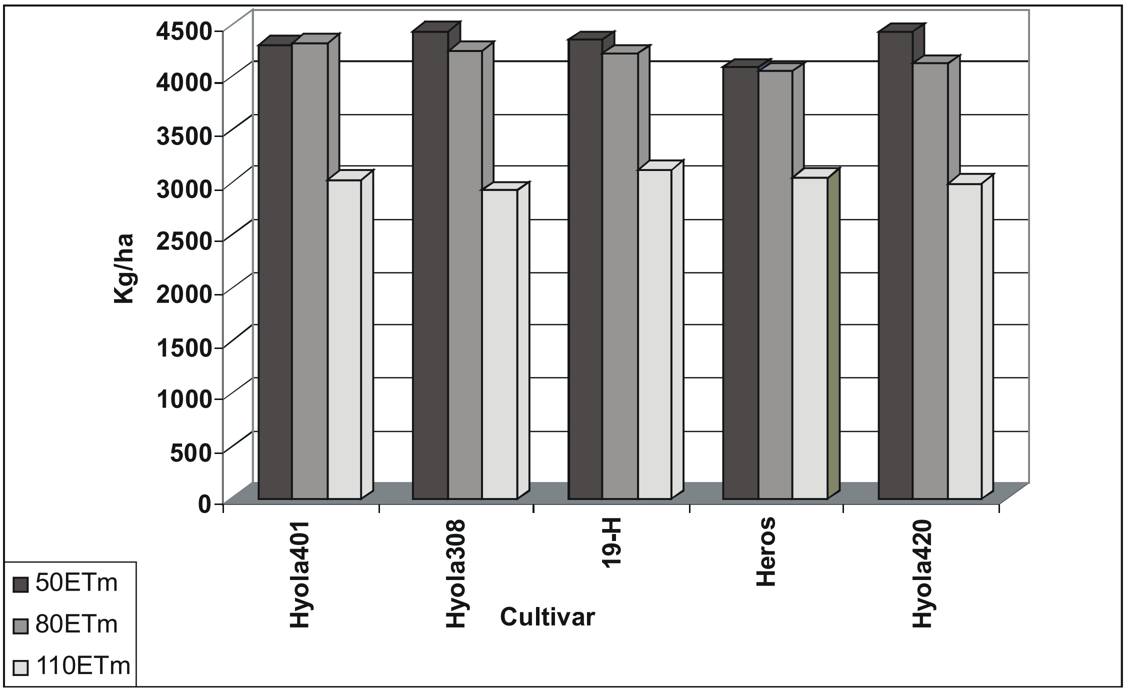


Fig.1. Interaction effects of Irrigation & Cultivar on Grain Yield

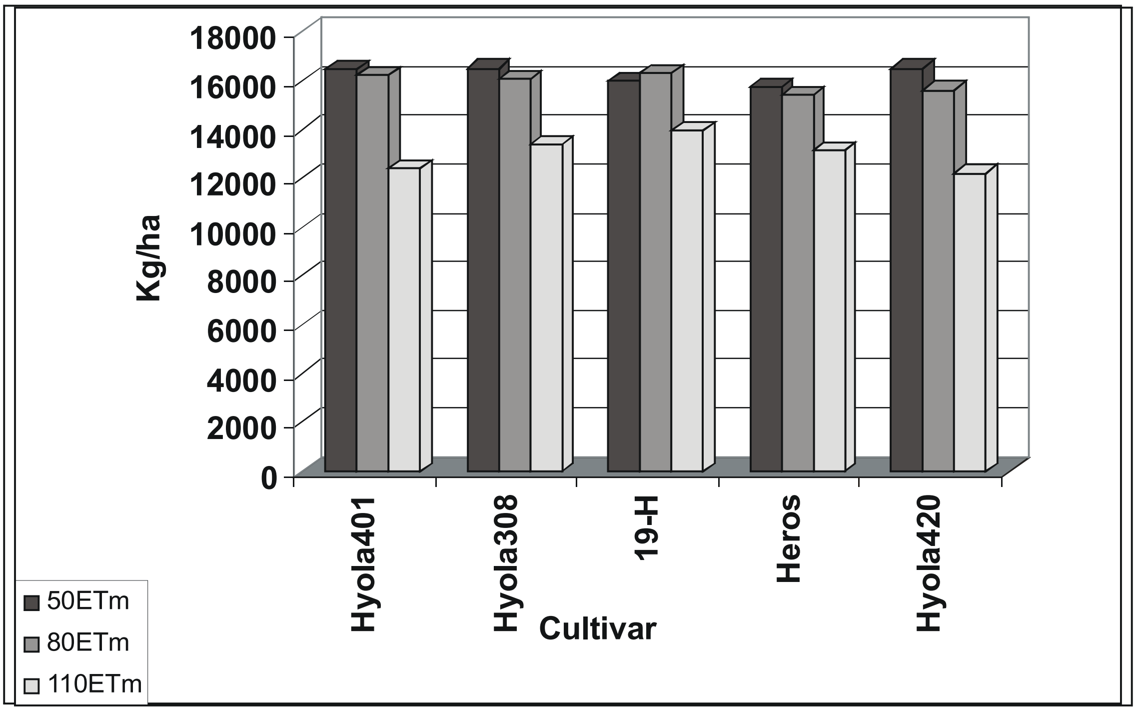


Fig. 2. Interaction effects of Irrigation & Cultivar on Biological Yield

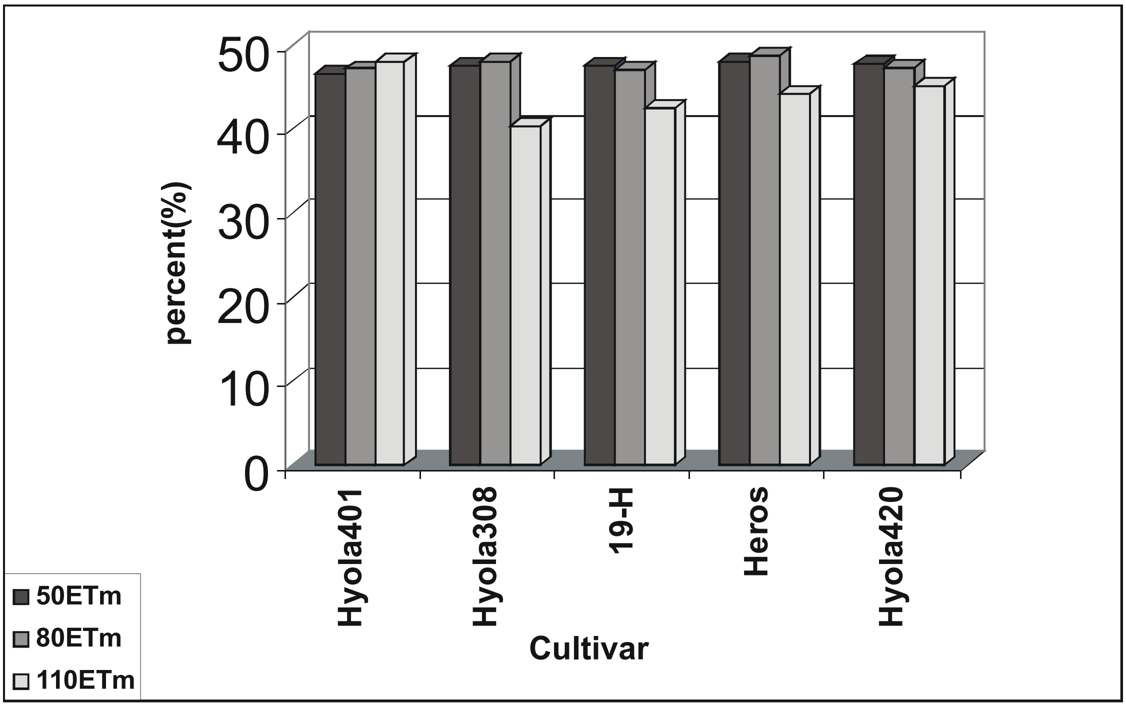


Fig. 3. Interaction effect of Irrigation & Cultivars on Oil percent

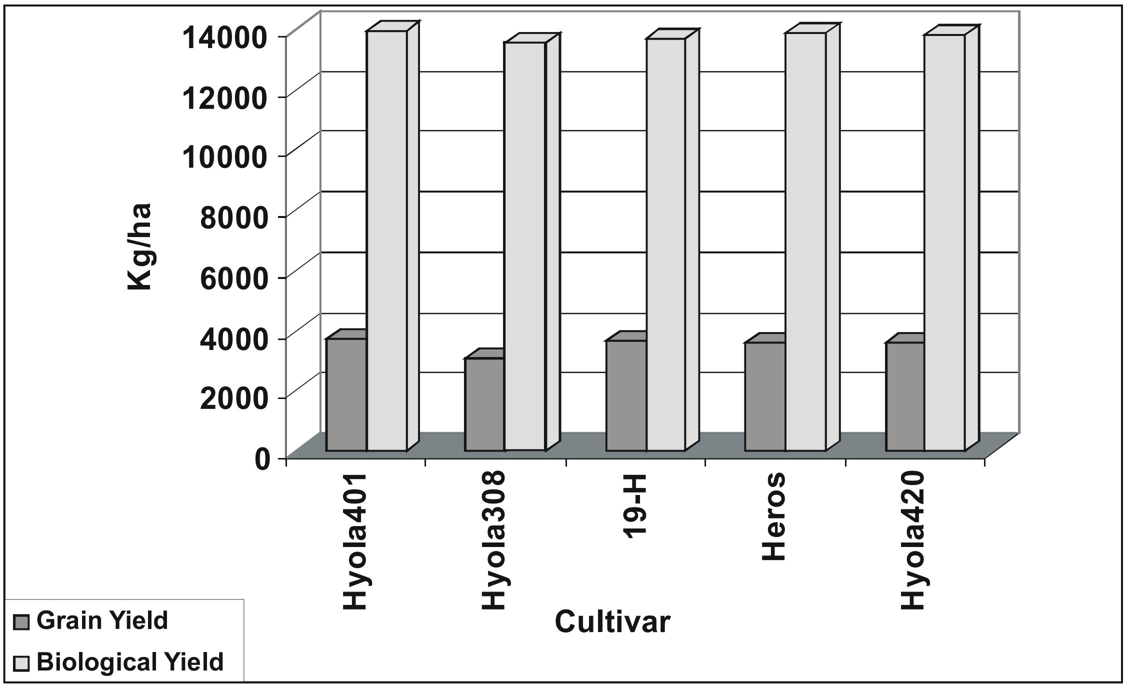


Fig. 4. Effect of cultivar on G.Y and B.Y

According to Nasery view point , severity of humidity in time of flowering and pod formation is more loss as any other time specially when along with high temperature (8). As per Nuttal et al ( 1992) rainfall in growth seasons and heat temperature are good indexes for potential of Canola yield (21).

Also table 3 show that minimum and maximum oil percent belonged to Hyola308 (40.30%) at 110 ET and Heros (48.8%) at 80 ET respectively that had significant different together. Amount and velocity transfer of assimilates including plant photosynthesis is depends on plant reverse action and absorption of environmental stimulus, enzyme-hormone and avandi system operation and respective effects of these factors appeared in form of grain filling and velocity and have key role in grain resistance operation (DuDaka and Gayianas, 1991).

Therefore, results showed that with 30% water saving may could produce maximum Grain yield and Oil percent without significant different with Hyola401 cultivar of ***Brassica napus*** L. and also in 110 ETm condition; 19-H, Heros c.v recommended for planting to best economic and water saving result. For correct and better results, test should be performed in number of years.

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