Study on Some Physiological Indices and Final Yield of Spring Cultivars Species of Rapeseed

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Abstract

In order to evaluate the yield and physiological indices of 13 spring cultivars of rapeseed , an experiment was conducted in 2007 growing season at Khorasan Razavi Agriculture and Natural Resources Research Center ,Mashhad-Iran. These cultivars were from three rapessed species belonged to *Brassica napus, Brassica rapa and Brassica juncea*. The experimental design was Randomized Complete Block Design with four replications. Result showed that there was a considerable differences between yield and LAI of cultivars.Cultivars of *B.napus* had more value of physiological indices than cultivars of *B.rapa.* So the yield of *B.napus* was more than that cultivars of *B.rapa* . A maximum GAI was observed with receiving 744.7 GDD at flowering stage and after that lessening trend of GAI was gradually acquired with mild slope. A maximum NAR was obtained with acquiring 367.6 GDD at early stage of growth and after that NAR diminished during growth season so it reached on minimum value at flowering stage. Afterward NAR increased again by receiving 1043.3 GDD at pod formation stage. Also we concluded that value of NAR at pod formation was more than that it achieved at early stage of growth.

Keywords: *B.napus , B.rapa , B.juncea* , Physiological parameters .

Introduction

Rapeseed is a valuable oilseed crop in Iran, that its cultivation has increased recent years. Our knowledge about physiological limitations of its yield formation, helps for better field management. To analyse yield , we focused on growth indices which determine seed yield. Plant dry matter is a product of assimilate partitioning and is one of the most important factors for seed yield determination. Growth pattern is affected from dry matter accumulation (Diepenbrock, 2000). Habekette (1993) reported that, the maximum DM is obtained at the end of flowering. Thurling (1974) found a positive relationship between total DM and seed yield. Crop growth rate explain the best concept of growth and is a measure of interaction effect between plant and photosynthesis (Clarke & Simpson, 1978). There is some differences for this index in *Brassica* oilseed species (Arvin, 2008). Relative growth rate is product of net assimilation rate and leaf area ratio (El-darier *et al.*, 2002).The average of RGR in *Brassica rapa* is greater than *B.napus* and *B.juncea*, shows its higher efficiency for growth. This is very obvious in early maturing cultivars of *B.rapa* (Kasa & Kondra, 1986) . Differences between cultivars of rapeseed for leaf area index is observed from early flowering. Canopy can reach to a maximum LAI=5-6 , for intercepting the majority of light(Mendham *et al.*, 1981; Arvin, 2008).

Net assimilation rate is the rate of dry matter accumulation per unit of leaf area during the growing season. NAR has a different trend in rapeseed compared to the other crops. It move descently throughout the season, but in the time of appearance of pods, its trend will be ascendant because of a

very powerful sink is shaped (Arvin, 2008). Koller *et al.* (1970) had been reported the re-increasing of NAR in soybean because of promoting of photosynthesis and increased seed demand for nutrient materials.

Material and Methods

In order to study the physiological indices which determine seed yield of spring oilseed rape, an experiment was conducted in 2007 growing season with 13 spring cultivars of rapeseed. The location of this research was Khorasan Razavi Agriculture and Natural Resources Research Center, Mashhad-Iran. These cultivars were from three rapessed species belonged to *Brassica napus, Brassica rapa and Brassica juncea*. The experimental design was Randomized Complete Block Design with four replications. Physiological indices that evaluated were: DM, LAI, CGR, RGR, NAR, and also seed yield. All of indices were determined based on Days and Growing Degree Days (GDD).The methodology of computing these indices has indexed by Hunt (1990).

Result and Discussion

Results showed, a significant difference among cultivars for yield, and growth indices (Table 1). Hyola 330 with average of 1475 Kg.ha-¹, BP18 with 1277 Kg.ha-¹, and Hyola 401 with 1247 Kg.ha-¹, had the highest seed yield in this experiment.

Table 1. Mean comparison of maximum physiological indices at flowering stage and yield of spring cultivars of the oilseed rape .

Cultivars	TDM ($gr.m^{-2}$)	CGR ($gr.m^{-2}.day^{-1}$)	RGR ($gr.gr^{-1}day^{-1}$)	LAI	Yield ($Kg.ha^{-1}$)
B.napus					
Hyola 401	1193.50^{ABC}	53.01^{AB}	0.05^{AB}	6.13^{AB}	1274^{A}
Hyola 330	1805^{A}	64.98^{AB}	0.03^{AB}	7.08^{A}	1475^{A}
Option 500	1274.90^{ABC}	88.71^{AB}	0.09^{AB}	4.92^{ABCD}	464.3^{E}
Sarigol	1072.60^{BC}	15.74^{B}	0.01^{AB}	6.00^{AB}	526.8^{DE}
RG003	931.60^{BC}	64.98^{AB}	0.09^{AB}	5.07^{ABCD}	1007^{B}
Zarfam	1653.90^{AB}	148.56^{A}	0.12^{A}	7.36^{A}	75.89^{F}
Echo	678.10^{C}	33.27^{AB}	0.06^{AB}	2.37^{D}	745.5^{C}
Swchotshot	875^{C}	31.72^{AB}	0.01^{B}	2.53^{CD}	495.5^{E}
B.rapa					
Parkland	943.20^{BC}	43.64^{AB}	0.05^{AB}	3.70^{BCD}	757.4^{C}
GoldRush	667.30^{C}	33.03^{AB}	0.05^{AB}	5.18^{ABC}	46.12^{F}
Rinbow	949.40^{BC}	51.87^{AB}	0.05^{AB}	4.80^{ABCD}	928.6^{BC}
Hysun 110	999^{BC}	63.07^{AB}	0.75^{AB}	3.44^{BCD}	711.3^{CD}
B.juncea					
B.P18	1064.10^{BC}	54.25^{AB}	0.04^{AB}	3.07^{CD}	1277^{A}

Results of maximum dry matter showed significant difference (P≤ 0.05) for cultivars.Hyola 330, with 1805 g.m-² had the highest and Goldrush with 667.3 g.m-² had a lowest DM. The greater DM for Hyola330, the higher its yield. Cultivars of *B.napus* have greater DM at flowering compared to *B.rapa* (Si & Thurling, 2001). These differences have shown in ***Fig.1*** for three delegates of *Brassica* species.

CGR showed significant differences, so that the averages of CGR for rapeseed cultivars were 62.62, 54.25 and 47.9 g.m-².day-¹ for *B.napus, B.juncea, B.rapa* respectively. Hyola330 had higher growth rate and cumulative dry matter when entered in flowering stage and this superiority remained until end of growing season (***Fig.2***).

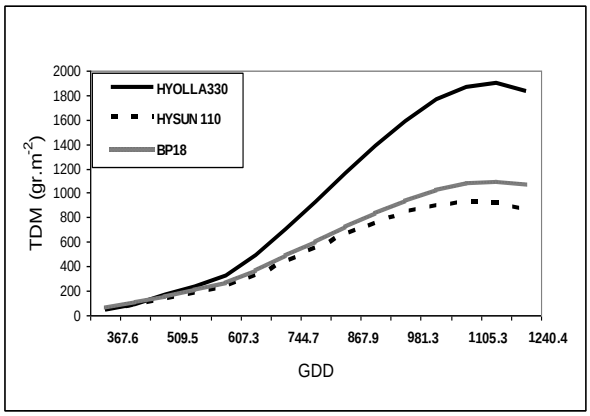

Fig 1- TDM trend at three spring cultivars of rapeseed

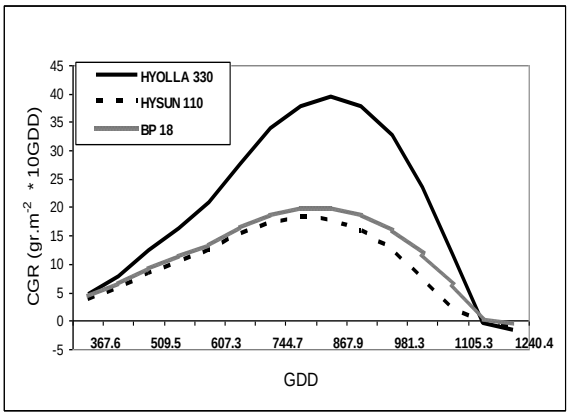

Fig 2- CGR trend at three spring cultivars of rapeseed

There were no significant difference for RGR, but the average of this index was greater in *B.napus* and *B.rapa* compared to *B.juncea* cultivars. Anyway the RGR of Hyola330 was superior between alls. This is another reason for its higher seed yield and potential of such a cultivar in assimilate synthesis and translocation to developing seeds (Kasa & Kondra, 1986).

Maximum LAI, was significantly different for cultivars. Hyola330 had a very high LAI in addition to the other proper indices that led to its higher seed yield.

Fig.3 , shows the NAR trend in three cultivars from different species of rapeseed.

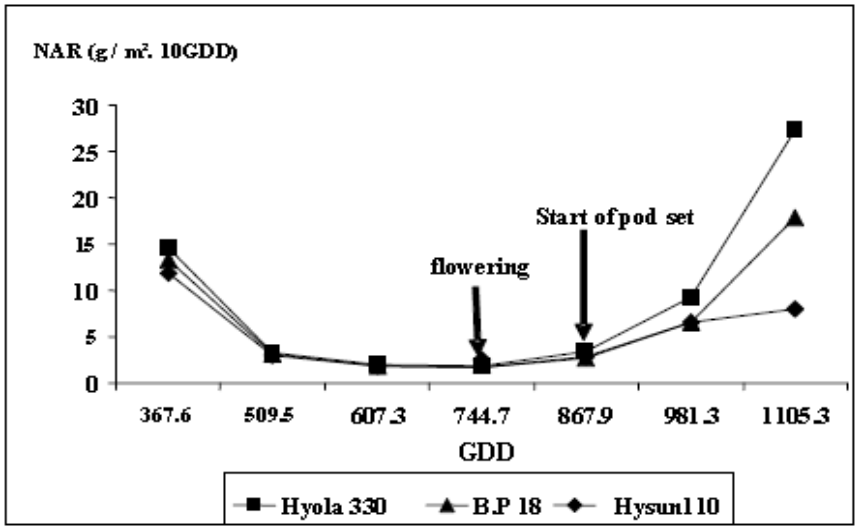

Fig 3- NAR trend at three spring cultivars of rapeseed during growing season

Obviously most crops have high level of NAR at the first stage of their own growth but step by step this trend as consequence of leaves shading will be lessened. Oil seed Rape have this NAR trend until flowering stage but after pods appearance which replace by leaves, NAR rate to be increased again.

We can suggest two reasons about NAR raising after pod setting .First is, pods shading are so much less than leaves shading. Therefore rate of light penetration in the pod canopies are high. The second reason is that pod canopies have more *dry matter efficiency* per green area index than leaves solely. From middle of pod filling to maturity, the greatest NAR was belonged to *B.napus* . Diepenbrock (2000) has confirmed in his review," the developing pod surface can intercept and use incoming solar radiation to a great extent. From the start of flowering a drastic decline in LAI is occurred and simultaneously pod area increase, then the total net CO2 fixation by pod hulls exceeds that of leaves,because pods are exposed to much higher radiation than leaves".It is the main reason for end season increasing of NAR.

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