Estimation of winter canola (*Brassica napus* L.) growth curve under different weed interference durations

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Abstract

In order to estimate winter canola (Okapy Double Zero) growth curve under different weed interference durations, an experiment was conducted at research field of Tarbiat Modares University (located on Tehran west, Iran) on 2004. The experiment had 14 treatments and 4 replications that divided in two sets of treatments and were arranged in a randomized complete block design. In first set of treatments, the crop was kept weed-free until 2, 4, 6 and 8 leaf stage, inflorescence emergence, 50% silique set and harvest stages. In second set of treatments, weeds were allowed to grow with crop until above stages. Data were obtained via 18 sampling from experimental units during canola growth. Results showed that leaf dry weight trend was rising but after flowering began to fall. Stem dry weight intensively increased in all treatments after winter elapsed and starting the generative stage, then began to decrease after flowering. Total dry weight curve had increasingly pattern but began to reduce after flowering. Leaf area in canola expanded until flowering and then began to fall. Regarding to weed free treatment (whole season control) and highly weed infested (all season interference), different interference periods had no effect on crop plant parts. Although in all of growth curve amount of dry matter production in all plant parts and leaf expanding was greatest in weed free plots and was lowest in highly weed infested plots. Attending to weed flora, their population and time of interference, final results showed increasing process of dry matter in all plant parts of canola and expanding leaf area did not affect by weed interference periods.

Key word: Weed interference, *Brassica napus* L. Weed control, competition, Dry matter, Leaf area

Introduction

Understanding how a canola plant grows and how growth can be affected by different management is too important to make effective management decision. Proper timing of application based on growth stage of the crop, can improve the product's efficiency and prevent injury and economic loss. Weed existence and competition in crop fields reduce crop leaf area expansion, dry matter distribution and yield. Bukun (2004) showed that increment of weed existence duration reduced plant height and cotton biomass. Findings of Yenish and Young (2004) in evaluating wheat competition with goatgrass(*Aegilops cylindrica*) indicating 30-70 percent losses in spike biomass due to weed competition. High density of weed population can prevent radiation transmittance to lower part of crop canopy. The similar result was happened for corn canopy; in such a way leaf senescence till 14- leaf stage reduced the effective green leaf area of the crop (Hall, 1992). Soybean leaf area index affected by duration of weed interference (Ehteshami and Chaeichi, 2001). Aguyoh and Masiunas(2003) reported that dramatics height and leaf area of pigweed made a dense shade effect on common bean canopy and therefore reduced significantly it's leaf area.

The main object of current research is to study winter Canola (*Brassica napus* L.) responses to competition ability of natural weed population of the field under Tehran climatic conditions, which will be achieved by investigating dry matter distribution and leaf area trend in canola growth season.

Materials and Methods

Experiment was carried out during 2004-2005 growing season in the Research field of Tarbiat Modarres University (College of Agriculture) which located at Tehran, 35° 43´ N and 51° 8´ E with approximately 1245 meter above sea level. This Location has mean annual precipitation as 247.4 mm. Soil texture was sandy loam.

Fourteen treatments were arranged in a RCBD with 4 replications. Canola seeds (Okapy Double Zero) had sown on Sep. 16th. Each plot has 5 rows, of 4 m long with 30 cm row space; treatments were set in 2 groups: Control period and Interference period. In control treatments canola kept weed free from emergence time till two-leaf stage (V2), four-leaf stage (V4), six-leaf stage (V6), eight-leaf stage (V8), Inflorescence emergence (IE), %50 of silique set (%50,SS) and harvest stage (H)[A standardized growth stage scale developed by BASF, Bayer Ciba- Geigy and Hoechst called BBCH decimal system provides an accurate and simplified approach to describing canola growth stages]. In Interference treatments all weed species were allowed to grow with the crop until above mentioned growth stages of canola. These phonological stages coincided to 12, 19, 32, 39, 176, 200 and 240 days after canola emergence. Hand hoed weed species of interference treatments divided to definite species and settled to electrical oven (72 hours in 80 degree of centigrade) to calculate plant dry weight. Canola harvested end of season and grain yield reported with %14 humidity.

In order to draw growth curve of canola, 18 destructive samplings were taken during canola growth period started 12 DAE with 15 days intervals. In each sampling total dry matter, stem and leaf dry weight were measured separately using oven dried plant parts weight. Also canola leaf area index calculated using leaf area (measured by leaf area meter, ΔT Devices, England) per harvest area. Analysis of variance of experimental data were done using PROC ANOVA (SAS, 2003) and means compared by Duncan's multiple range test in 5% probability level.

Results and discussion

Total dry weight

There is an increasing trend of total dry weight in early vegetative growth stages of canola. General trend for all control treatments was basically the same (Fig. 1 and 2). Dry matter accumulation stopped when canola entered to the rosette stage, whereas by flowering stem appearance(Inflorescence emergence) in early spring, dry matter increasing rate reached to maximum level, in such a manner the greatest dry weight were obtained approximately one- three weeks before harvest. After that leaf abscission reduced total dry weight.

In spite of several weed species existence like as common purslane (*Portulaca oleracea*), common lambsquarters (*Chenopodium album*), redroot pigweed *(Amaranthus retroflexus),* jimsonweed *(Datura stramonium)* tumble mustard (*Sisymbrium altissimum*) and wheat (*Triticum aestivum*), interference treatments have no significant effect on dry matter production in canola, however in weed infested treatment until canola tow-leaf stage(WI v2, 12 DAE), and in full competition (WI H, 240 DAE) canola produced maximum and minimum biomass yield respectively. On the contrary maximum and minimum dry matter yield in control treatments were obtained in weed free plot (WF H) and weed free till 2 leaf stage (WF v2) treatment respectively.

Stem dry weight

The pattern of stem dry weight accumulation in control and interference treatments was similar to the trend of total dry matter (Fig. 1 and 2). Meanwhile after rosette stage (starting of stem elongation) the rate of dry matter accumulation was very faster than vegetative growth stages.

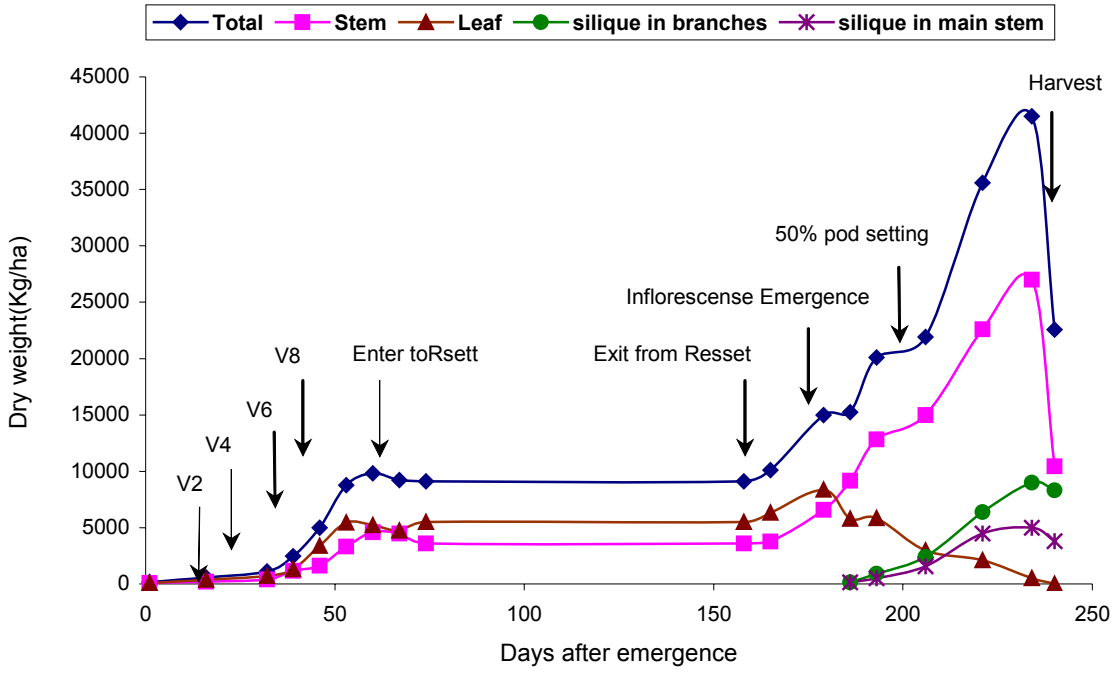

Figure 1. Trend of dry matter accumulation of canola in different plant parts in weed infested treatment until V2 (WI V2).

Generally control and interference treatment have not significant effect on changing the curve of stem dry weight of canola. However WI V2 (12 DAE) has the greatest stem dry weight in all stages and for WI H (240 DAE) was the lowest.

Leaf dry weight

The pattern of canola leaf dry weight not influenced by weed control and weed interference treatments. Some important details in this subject are available from the figure 1 and 2.

Leaf area index

Canola leaf area index against days after emergence has shown in figure 3. Result indicates this physiological index not changed significantly under weed control or interference treatments. It seems weed density in this experiment was not as much as enough to decrease crop LAI. Weed invasion period divided to two distinct times, coincident with canola emergence and

the second was close to stem elongation. In first stage emerged weed were often summer annuals which destroyed starting cold weather. In second stage spring annuals like as *sisymbrium altissimum* confronted to established canola population. Altogether results indicate that exist weed in this experiment were not able to affect trend of dry matter accumulation and leaf area expansion of canola.

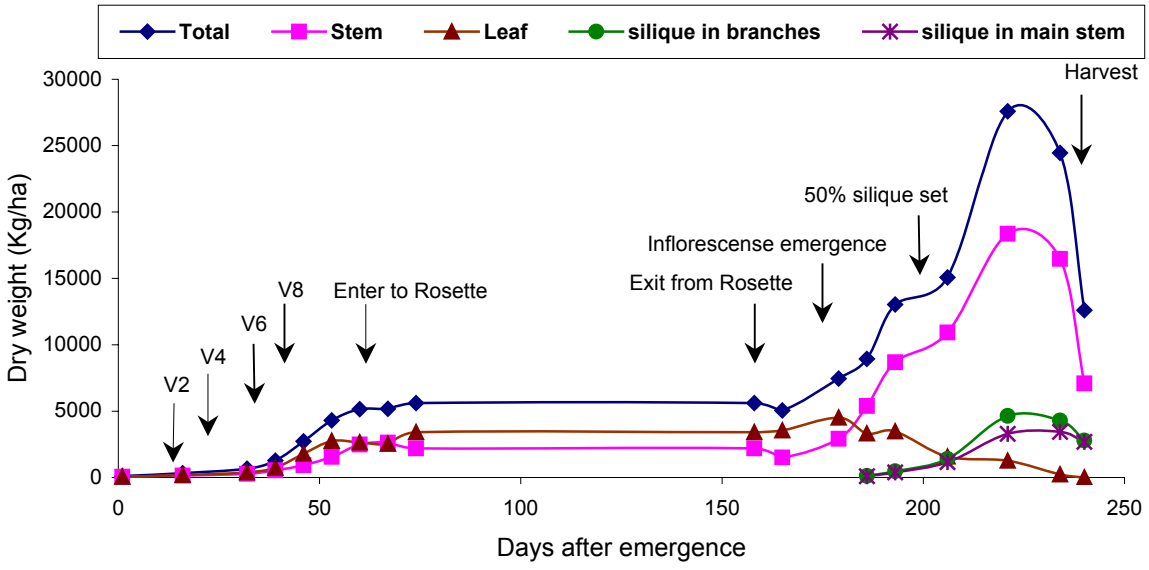

Fig. 2. Trend of dry matter accumulation of canola in different plant parts in full competition treatment (WI H).

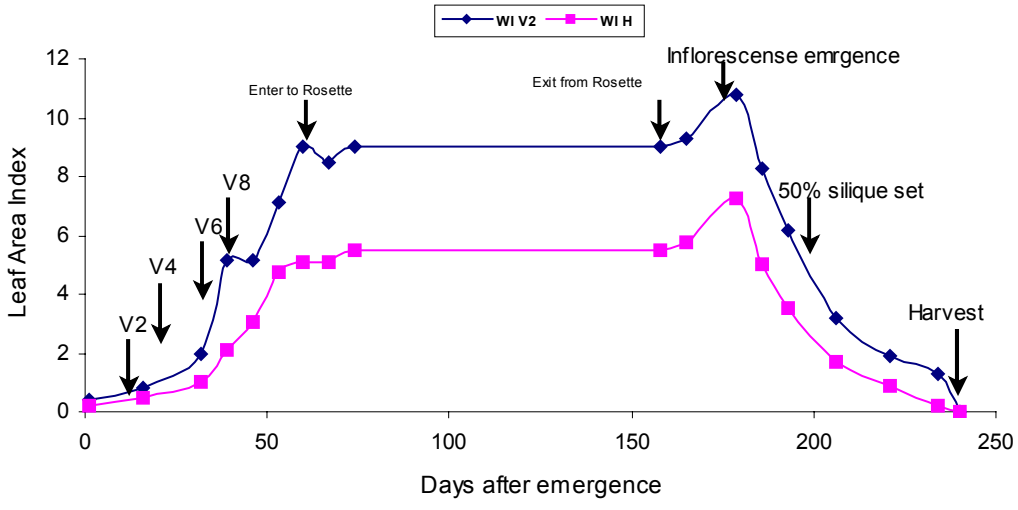

Figure 3. Leaf area index of canola during growth stage in weed infested treatment till V2 (WI V2) and full competition treatment (WI H).

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