The Effect of Different Sowing Date and Plant Density on Some Morphological Traits, and Yield Components of Canola Plant (*Brassica napus* L.) A preliminary Study

Abdo Bakri Fakirah* Kholod Muhammed Al- dhubibi**

Abstract

This study was conducted at the farm of Faculty of Agriculture, Sana'a University during 2013 seasons. The objective of the study was to determine the effects of three different sowing dates (Feb.-10th, Mar.-10th, and Apr.-10th) and three different planting densities (12.5, 25 and 37.5 plant/m^2) on some morphological traits and yield components of Canola plant (*Brassica napus*) Pactole variety. Split Block Plot Design was used for experimental design with three replications. Experimental results showed significant differences between planting dates. The first planting date (Feb -10th) gave the highest plant height, leaf number/plant and maximum seed weight/plant, as compared to plants grown under hot weather condition in April-10th, which showed relatively decreased in plant height, leaf number/plant and seed weight/plant. No significant differences were found between the three sowing dates on 1000 seed weight and seed yield characters. No significant differences between planting densities on plant height, leaf number/plant, seed weight/plant and seed yield traits. The results also indicated interaction between sowing dates treatments and plant densities on plant height, leaf number/plant, seed weight/plant, and 1000 seed weight characters. We conclude that, Canola plant respond under the effect of dates planting and plant densities under Sana'a conditions , it is recommended to conduct other studies at different areas for this an important oil crop

Keywords: sowing dates – plant density – Canola plant- Yemen.

Introduction:

Canola (*Brassica napus* L.) is an important oilseed. Its production reached 17.95 million metric tons and has become the third important oilseed crop in the world. It comes only after soybean and palm oil [50]. Canola is cultivated as winter crop in part of Europe and Asia. While in Canada, Northern Europe and parts Australia, it is cultivated only spring season [46]. Canola has high adaptability under different environmental conditions especially under drought, salinity and temperature stresses. It has commercial importance due to high (30-45%) oil content. Canola oil contains low percentage of glucosinolate and erucic acid as compare to high erucic acid in rapeseed oil of the same genus [38]. High erucic acid caused cardinal problems in humans [15] .

In agricultural systems, yield efficiency is influenced by interaction between genetic, agricultural practices and environmental factors. Soil type and salinity [6 , 21], sowing dates, seed rate and row spacing are some of these factors that are very important for higher yield production [45]. Sowing date is a critical and one of the most important production factors influencing crop yield and other agronomic traits. The optimization of sowing time for winter rapeseed is essential. Ozer [36] concluded that the yield differences measured for sowing dates were primarily due to the changes in branch number, pod number per plant, and 1000 seed weight. Sowing date can be important to avoid high temperature**s** at flowering period and at the end of growing season. It also depends on the onset of significant rainfall, temperature and humidity in the region. For *B. napus*, 20°C is the optimum temperature during flowering stage [3] Flowering is the most sensitive stage for temperature stress damage, probably due to vulnerability during pollen development, an thesis and fertilization [16]. Suitable climatic conditions and latitude are key factors for sowing date of the crop [31; and 13]. Sowing either too early or too late has been reported to be unfavorable [18, 40, 51]. Most previous studies have revealed that late sowing in many crops results in lower yields [43, 28, 18, 35, 36, 40,51]. A number of studies have shown seed yield decline in canola with delay in sowing date [48]. The reduced yield at later sowing date was attributed to production of lesser pods/plant.

[49] concluded that later sowing date generally reduced number of pods /plant and number of seed /pod. [44]. In Pakistan, a study on ten canola varieties found that delaying planting date significantly increased Aphid population density and caused poor plant growth and consequently low yield. [25] evaluated three canola cultivars at four sowing dates and found that seed yield was the highest at the first two sowing dates. [26]

* Agronomy and Pastures Department Faculty of Agriculture , Sana ' a university.

** Agriculture Economic Faculty of Agriculture - Sana'a university.Received on 22/3/2017 and Accepted for Publication on 7/5/2018

stated that seed yield and oil content were greater in the early planting dates and smaller in the later planting dates. [20] found that highest yield of canola was observed from early plantings time. [2] and [39] reported that different sowing dates produced significant effect in 1000 seed weight. [9] found heights yield and 1000-seed weight with early sowing time. In Australia, no seed yield differences were found for canola sown in April and May [48]. [33] showed that flowering of canola is inhibited at temperature above 27°C. [32] reported complete sterile flowers in canola at 27/17°C. There was a positive relationship between number of flowers per plant with the number of days to flowering, however the reproductive period (flowering and seed filling periods) of the early-sown canola is longer than that of the late-sown crop, therefore, contributing to a higher flower and pod number. The delay in sowing led to more rapid development of the crop, decreased days to flowering, flowering period and flower and pod number per plant.

Plant density is an important factor influencing rapeseed yield. Plant density in rapeseed governs the components of yield and thus the yield of individual plants.. [36] and [34] reported the rape grown at the highest plant densities produced smaller plant**.**. [1] investigated the effects of different plant densities ranging from 20 - 30 plants/m^2 in rapeseed. They concluded that seed weight per plant decreased as plant densities increased. The number of pods per plant is the most responsive of all the yield components in oilseed rape [8,10] stated that pods per plant, seed weights and dry matter per plant decreased as plant density increased.. [29] also reported that plants grown at high density had increase in 1000-seed weight but, more branches and fewer pod-bearing. Previous papers which found out that 1000-seed weight was not significantly affected by plant densities [27, 34, 11 , 36]. [7] obtained that narrow row spaces had more yield than wide rows. [4] reported that sowing density influenced positively towards yield by 31.68%. However, some reports indicated non-influence of plant density on some characters of rapeseed crop Total yield, 1000 – seed weight [22], 10000-seed weight and seed yield [9], yield and yield components [14] and plant height [45]. On the other hand [37] reported an increase in seed yield up to 50 plants/m^2, while seed yield was unaffected when density was between 50 and 130 plants/m^2.However, [5] reported seeds yield in lower plant densities .Besides , they indicated more efficiently control of weeds in higher plant densities. [23] indicated the high plant population can also contribute to the control of the growth and development of weeds in rape seed plants.

The present investigation aimed to evaluate the response of canola plant under different of sowing dates and plant densities . This is the first study on this crop in Yemen as trying to introduced it instance of sun flower plant which needs big inputs.

Materials and Methods:

The present study was carried out at the Agricultural Experiment Station, Faculty of Agriculture Sana'a University, during 2013 growing season to study the effect of three different sowing dates (Feb.-10^{th}, Mar.-10^{th} and Apr.-10^{th}) and three different plant densities (12.5, 25 and 37.5 plant/m^2) on some morphological traits , and Yield components of Canola plant (Pactole variety).

Split - plot design experiment with three replications was used. The main plots were assigned to the three sowing dates treatments, whereas the sub-plots treatments were assigned to the three plant densities, total experimental units 27 unit, Sub-plot size was 2 m long and 2 m apart (total area of 4 m^2) with 40 cm between each two rows and 20 cm between hills in each row. Before sowing, land was fertilized with Super phosphate (46 % P_2O_5) at the rate of 120 kg/ha and Nitrogen fertilizer, in the form of urea (46% Nitrogen), was also applied at the rate of 80 kg N/ha 20 days from sowing. Weeds were controlled by hand; climatic data are given in Table (1) Soil was analyzed at the laboratory of Soil and Water Department in the faculty. Data of soil texture analysis are given in Tables (2, 3).

At harvesting time, ten random plants were tagged in each sub- plot. The following traits were measured: plant height (cm), number of leaves/plant, Seed weight/plant (g) and 1000– seed weight (g). Then the seed yield/ha was determined from the yield of the internal three rows and converted into kg/ha. For the experiment, data of the studied characters were analyzed by SAS program (1992).

Table (1) Mean recorded temperature and humidity at the experimental site during 2013 growing seasons

Months	Temperature (ºC)	Humidity (%)	Rain (mm)
February	17.4	43	1.4
March	17.9	47	8.1
April	19.3	47	14.2

Source: Civil Aviation &Meteorology Authority.

Table (2): Chemical properties of soil of the experimental site.

Soil depth (cm)	PH soil	O.M (%)	Total nitrogen (%)	Phosphor Mg / Kg	Potassium Mg /kg
0 – 30	8.30	0.95	0.09	5.80	150.13

Table (3): Physical properties of soil of the experimental site

Soil depth (cm)	EC (dS / m)	Clay (%)	Silt (%)	Sand (%)	Soil texture
0 – 30	0.4	15.50	25.80	58.70	Sand silt

Results and Discussion:

Analysis of variance for plant height, leaves number per plant, Seed weight/plant(g) , 1000 seeds weight (g) and Seeds yield (kg / ha) are presented in Table (4). Mean square (Table 4) showed a significant effect of three sowing dates which was found for leaves number/plant and seed weight/plant at 0.05 level of probability.

Table (4): Summary of analysis of variance of canola crop under the effects of sowing dates and plant density (2013 seasons)

S.O.V	D. f.	Plant height (cm)	Leaves number/plant	Seed weight/ plant (g)	1000 seeds weight (gm)	Seeds yield (kg / ha)
Sowing dates (sd)	2	4340.55^{ns}	19.905700^{*}	23965.0954^{*}	0.297704^{ns}	1529751.08^{ns}
E.M.S. (a)	4	978.41191	1.525700	3005.05093	0.28425454	1714455.10
Plant density (pd)	2	55.8560^{ns}	0.267811^{ns}	979.87315^{ns}	0.180886^{ns}	2203666.9^{ns}
(sd x pd)	4	120.3151^{ns}	0.792144^{ns}	52.75648^{ns}	0.110004^{ns}	205701.62^{ns}
E.M.S. (b)	12	93.723100	2.111700	1309.2537	0.092723	1919848.80

According to the means of the studied traits, presented in Table (5) the results show that plant height significantly decreased after Mar.-10^{th}, the Feb.-10^{th} date achieved the highest plant height

(141.41cm) ,then decreased to 97.61 cm on Apr.-10th. The increase in plant height might be due to the plants in the Feb.-10th sowing date which had taken advantage of suitable weather, moderate temperature which comparing with plants grown under hot weather condition in the late sowing date of the Apr.-10th to grow, and as a result the environmental influences greatly affect plant growth, the study.

results are confirmed with the results obtained by [12]; [48]; [25]; [18], [20] and (31] reported that the sowing date depend on the overall effect of environment factors, and the delay sowing date leads to a decrease in plant height [30]. The results in (Table 6) showed no significant differences between the different plant densities on plant height in compara is on with the results found by.[45] who stated that plant height was not affected by seeding rates, while others presented that the increase in seeding rates leads to an increase in the plant height [47] and , decrease in plant densities caused reason increasing in plant height [36 and 34], while the increased in plant densities significant reduction plant height [2].There is a comparison of the mean of plant height Figure (2 A) as affected by the sowing date. The results also indicated interaction between sowing dates treatments and plant densities on plant height .

The results in Table 5 show that leaves number per plant responded to sowing dates, the 10th of Feb produced the highest leaves number per plant 13.119 leave/plant, while the lowest 10.222 leave/plant was found at 10th of Apr. date , no significant differences were found between Feb.-10th , and the 10th of Mar. sowing dates. Similar results were obtained by [44] who found that delaying sowing date significantly decreased plant growth which is related directly to environmental and genetic factors. The results indicated no significant differences were found among plant densities treatments on leaves number / plant, (Table 6). Our findings are not in agreement with results reported by [41], and [42] whose results revealed that the decrease in plant growth and development was associated with an increase in plant density. The comparison of the mean of, leafs no/plant, Figure (2 B) is affected by the sowing date and plant density. There is an interaction between sowing dates treatments and plant densities on leaf number /plant.

Table (5): Effect of sowing date on growth and yield of canola (during 2013 season)

Treatments		Plant height (cm)	Leaves number /plant	Seed weight/plant(g)	1000 seeds weight(gm)	Seeds yield (kg / ha)
Sowing dates	Feb.-10th	141.41 a	13.1189a	40.49 a	3.9700 a	1742.2 a
	Mar.-10th	122.29 ab	12.2556 a	18.42 ab	4.3106 a	1406.0 a
	Apr.-10th	97.61 b	10.2222 b	8.63 b	4.0450 a	907.2a
L. S .D. (0.05)		40.94	1.6167	22.69	0.7333	1683.5

The maximum seeds weight per plant (40.49g) was given in the first sowing date (10th of Feb.), while the third sowing date (10th of Apr) gave the minimum seed weight (8.63g/plant). No significant differences were found between the second (10th of Mar.) and the third (10th of Apr.) sowing dates. The reduction in seeds weight per plant might be due to the adverse effect of temperature conditions during the stages of flowering , filling of the seeds and fruit setting of the late sowing dates, that also cause decrease number of pods per plant. These observations are in line with those of [44] and [22]. [49] concluded that later sowing date reduced number of pods per plant and number of seeds per pod.

No significant differences between different plant densities (12.5 ,25 and 37.5 plant/m^2) on seeds weight(g) /plant (Table 6). Similarly by [14] reported that yield components were no significantly influenced by seeding rates. However others studies [1] indicated that seeds weight /plant (g) decrease with plant densities increased. Comparison of the mean of, seed weight / plant Figure (1 C) as affected by the sowing date. The results showed interaction between sowing dates treatments and plant densities on seed weight/plant .

There was not significant differences were found between the three sowing dates of Feb- 10, Mar-10 and Apr- 10 on 1000 seed weight (g) Table (5). The reason might be due to that no variations

between the temperature which play role in the stage of the filling of the seeds during the three sowing dates (Table 1) . Our results differ with those of, [24] , [39] and [9] where they found significant effect on 1000 seed weight and the heights 1000-seed weight with early sowing. The results indicated no significant differences between three different plant density through increase plant densities from (12.5 to 37.5 plant/m^2) Table 6. This results, in general are in agreement with those obtained by [27, 34, 11 , 36, 22**,** and 14] , [9] who reported that there was no significant effect of different plant densities on 1000-seed weight . The results also indicated interaction between sowing dates treatments and plant densities on 1000 seed weight trait .

Table (6): The effect of plant densities on growth and yield of canola (during 2013 season).

Treatments		Plant height (cm)	Leaves number/plant	Seed weight/ plant(g)	1000 seed Weight (gm)	Seeds yield (kg / ha)
Plant Density (Plants/ m^2)	12.5	121.094 [a]	11.9556 [a]	19.822 [a]	3.9344	922.8 [a]
	25	117.681 [a]	11.9744 [a]	21.522 [a]	4.2172 [a]	1209.2 [a]
	37.5	122.531 [a]	11.6667 [a]	26.194 [a]	4.1900 [a]	2050.5 [a]
L .S .D . (0.05)		9.9435	1.4926	11.752	0.3225	1467.3

The results (Table 5) showed that there were no significant differences between the means of seed yield (kg/ha) among different sowing dates (Feb.-10^{th}, Mar.-10^{th} and Apr.-10^{th}) this might be interpreted to that Canola seed yield depends on some components such as number of pods per plant ,number of seed per pod , number of seed per plant , seed weight per plant and 1000-seed weight. And also seed yield can be attributed to the main yield components. In addition the environment factors greatly affect plant growth and yield . Our results are confirmed with that obtained by, [48] who reported no significant differences between the means of seed yield of canola plant at sown on April and May. These results are not in agreement with those obtained by [25, 18, 20, 31, 12 and 7] who reported that seed yield significantly responded to different sowing dates .

No significant differences were found among different plant densities in seed yield (Table 6).

This might be due to that plant densities used were not enough to increase seed yield as result to the canola plant had less efficiency to control the weeds which competites the Canola plant. Similar results obtained by,[23] ,.[5] who reported that low seed yield in lower plant densities besides the high plant density had more efficient control of weeds in high plant densities and can also contribute to the control of growth and development of weeds in rape seeds plants. This agrees with the previous work which found that seed yield and yield components were not significantly affected by plant densities as reported by [9] ; [22] and [14]. These observations were not supported by the findings of. [34], [41] and [42] who reported that high seeding rates reduced seed yield, while other workers found that increasing seeding rates resulted in an increased seed yield [8 , 47, and 52].

Conclusion:

We conclude that, Canola plant respond under the effect of dates planting and plant densities under Sana'a conditions , it is recommended to conduct other studies at different areas for this an important oil crop.

References:

1- Al-Barzinjy M., Stolen O., Christiansen J.L., Jensen J.E.(1999): Relationship between plant density and yield for two spring cultivars of oilseed rape (Brassica napus L.). Acta Agr. Scand. Sect. B, Soil Plant Sci., 49: 129–133.

2 - Al-Barzinjy M., Stolen O., Christiansen J.L., Jensen J.E.(2003):Effects of plant densities on yield, yield components and some morphological characters of two cultivars of oilseed Rape (Brassica napus L).Kurdistan Academician Journal.2(1) 87-95.

3 - Angadi, S.V., H.W. Cutforth, B.G. McConkey and Y. Gan, (2003). Yield adjustment by canola grown at different plant population under semiarid conditions. Crop Sci., 43: 1358-1366.

4 - Basalma, D., (2006). The Relationships among plant density, yield and yield components on winter rapeseed (Brassica napus ssp. oleifera L.). Journal of the Faculty of Agriculture Akdeniz University, 19: 191-198.

5 - Bilgili.U.,Sincik.M.,Uzan.a.,Acikgoz,E.(2003).The influence of row spacing and seeding rate on seed yield and yield components of forage turnip (Brassica napus , L.) . J . Agron .Crop Sci . 189 (4) : 250 - 254.

6 – Bybordi , A ., S . J . Tabatabaei and A . Ahmedov , (2010.) Effects of salinity on fatty acid composition of canola (Brassica napus L.). Journal of Food Agriculture and Environment, 8: 113-115.

7 - Christensen, J. V. and J. C. Drabble, (1984). Effect of row spacing and seeding rate on rapeseed yield in Northwest Alberta Canadian Journal of Plant Science, 64: 1011-1013.

8- Christensen , J . V ., W . G . L egge , R . M . Depauw, A . M . F ., Henning , J . S . Mckenzie , B . Siemens and – Clarke , J . M ,Clarke , F . R.,Simpson,G.M.(1978).Effects of method and rate of seeding on yield of Brassica napus Canadian Journal of plant Science, 58:549-550.

9 -Degenhardt,D.F. and Kondra,Z.P.(1981) The influence of seeding date and seeding rate on seed yield and yield components of 5 genotypes of Brassica napus. Can.J.plant Sci., 61:175- 183.

10 - Diepenbrock W. (2000). Yield analysis of winter oilseed rape (B. napus L.): a review. Field Crops Res. 67: 35-49.

11- Donovan J.T,(1996)Canola (Brassica rape) plant density influences Tartary buckwheat (Fagopyrum tataricum) interference biomass and seed yield.Weed Sci.42:385-389.

12 - El-Nakhlawy and M.O. Ghandorah (2007) Canola (Brassica napus L.) Seed Yield and Quality as Affected by Planting Date and Varieties. JKAU: Met., Env. & Arid Land Agric. Sci., Vol. 18 No. 1, pp: 13-20.

13 - Fink, N. (2006) An Evaluation of the Effects of Planting Date and Seeding Rate on the Yield of Winter Canola Grown at Three Different Geographic Areas , The ACSSA –SSSA , International Annual Meeting (Nov., 2006).

14 - Gaffar,M.A. and Mohammad ,H.(1988). Effect of different seed rate at different management levels on the performance of mustred.Bang.J.Sci. 23:62-66.

15 - Gopalan, C. D., D. Krishnamurthi, I. S. Shenolikar and K. A. V. R. Krishnamachari, (1974). Myocardial changes in monkey fed on mustard oil. Nutrition & Metabolism, 6: 352-365.

16 - Hall, A.E., (1992). Breeding for heat tolerance. Plant Breed. Rev., 10: 129-168.

17 - Hocking P.J (1993). Effect of sowing time and plant age on critical nitrogen concentrations in canola (Brassica napus L.). Plant Soil 155-156: 387-390.

18 -Hocking, P.J. and Stapper, M. (2001) Effect of sowing time and nitrogen fertilizer on canola and wheat. I. Dry matter production grain yield and yield components , Aust . J. of Agric . Res ., 52 : 623 - 634.

19 - Hocking PJ, Randall PJ, DeMarco D (1997). The response of dry land canola to nitrogen fertilizer: partitioning and mobilization of dry natter and nitrogen and nitrogen effects on yield components. Field Crops Research 54: 201-220.

20 - Horton, D.S. (2006). Determination of Optimum Planting Date of Seven Species of Winter Oilseeds in Mississippi, The ACSSA-SSSA. International Annual Meeting (Nov., 2006).

21 - Hosaini, Y., M. Homaeeb, N.A. Karimianc, S. Saadatd, (2009). Modeling Vegetative Stage Response of Canola (Brassica napus L.) to Combined Salinity and Boron tresses. International Journal of Plant Production, 3: 1735-8043.

22 - Hossain,M.A.S.Arabinda and M.J.Abedin, (1984.)Effect of seed rate and time of sowing on the yield of mustard under rain fed conditions. Bangladesh J.Agric.Res.9:54-57.

23 - O,Donovan,J.T.(1994).Canola (Brassica rape L.) plant density influences Tartary buckwheat (Fagopyrum tataricum) interference ,biomass and seed yield. Weed Sci.(42):385-389.

24 - Jain,V.K., Y.S.Chauhan,M.P. Khandekir,P.C. Jain,D.R.Rathore and R.N.Rathore.(1986). Performance of Raya under late sown conditions.Ind.J.Agron.31:374-376.

25 - Johnson, B., Muckay, K., Schneiter, A., Hanson, B. and Schatz, B. (1995). Influence of planting date on canola and crambe production. J. Prod. Agric., 8: 594-599.

26 -Kirkland, K. and Johnson, E. (2000). Alternative seeding dates affect canola yield and quality,Canad. J. Pl. Sci., 80: 713-719.

27- Kondra Z.P. (1977). Effect of plant size and seeding rate on rapeseed. Can. J. Plant Sci., 57: 277–280.

28 - Kondra ZP, Campell DC, King JR (1983). Temperature eff ects on germination of rapeseed (Brassica napus L. and Brassica campestris L.). Canadian Journal Plant Science 63: 1063-1065.

29 - Leach J.E., Stevenson H.J., Rainbow A.J., Mullen L.A. (1999). Effects of high plant populations on

the growth and yield of winter oilseed rape (Brassica napus). J. Agr.Sci., 132: 173–180.

30 - Mahmud Abadi A , Azizi M ,Gazanchian A.(2008).The effect of planting date on the agriculture of different types of winter Canola in the region of Bojnoored. The summary of the articles of the Tenth Congress of agriculture and plant Breeding Science of Iran.1387 August 19th-20th –Karaj.

31- Martin, V.L. (2006). Planting Date Effects on Winter Canola Production in Kansas, The ACSSA-SSSA.International Annual Meeting (Nov., 2006).

32- Morrison MJ . (1993) . Heat stress during reproduction in summer rape . Can . J . Bot . 71 : 303 - 308.

33 - Morrison MJ, Stewart DW. (2002). Heat stress during flowering in summer Brassica. Crop Sci. 42: 797-803.

34 - Morrison M.J., McVetty P.B.E. , Scarth R.(1990). Effect of altering plant density on growth characteristics of summer rape .Can. J.Plant Sci., 70:139 – 149.

35 - Ozer. H (2002). Sowing data and nitrogen rate effects on growth yield and yield components of two summer rapeseed cultivars. European Journal of Agronomy 19: 453-463.

36 - Ozer, H., (2003). The effect of plant population densities on growth, yield and yield components of two spring rapeseed cultivars. Plant, Soil and Environment 9:422-426.

37 - Potter, T. D.; J. R. Kay and I. R., Ludwig. (1999). Effect of plant density and sowing rate on Rapeseed cultivars with varying early vigour. Proceedings of the 10th International Rapeseed congress. Canberra. Australia. P. 10-14.

38 - Przybylski, R., T. Mag, N. A. M. Eskin, and B.E. McDonald, (2005). Canola oil. In: Fereidoon,S. (Editor), Bailey's industrial oil and fat products: Edible oil and fat products: Edible oils,Wiley~Interscience 2nd edn., p. 61-121.

39 - Rana Majid Rahman, M.Ashgar Malik, Zulfiqar Ali M.A.Cheema and Naeem Akhtar(2000). Determining a Suitable Seeding Time and Seed Rate for Harvesting a Rich Crop of Canola (Brassica napus L.) Pakistan J.of Biol. Sci. 3 (3) 534-536.

40 - Robertson MJ, Holland JF and Bambach R (2004). Response of canola and Indian mustard to sowing date in the grain belt of north-eastern Australia. Australian Journal of Experimental Agriculture 44: 43-52.

41- Rood,S.B. and Major,D.J(1984).Influence of plant density, nitrogen, water supply and pod or leaf removel on growth of oilseed rape. Filed Crop Research.8:323-331.

42 - Roy,K.M.and Paul,N.K.(1991). Physiological analysis of population density effect on rape (Brassica campestris L.) 1.Growth analysis.Acta Agronomica Hungarica.40(3-4),339-345.

43 - Scott RK, Ogunremi EA, Ivins JD, Mendham NJ (1973). The effect of sowing data and season on growth and yield of oilseed rape(Brassica napus L.). The Journal of Agricultural Science 81: 277-285.

44 - Shafique, M., Anwar, M., Ashraf, M. and Moula, B. (1999). The impact of sowing time on aphid management of canola varieties, Pak. K. of Zoology, 31: 361-363.

45 - Shahin, Y. and R. Valiollah, (2009). Effects of row spacıng and seeding rates on some agronomical traits of spring canola (Brassica napus L.) cultivars. Journal of Central European Agriculture, 10: 115-122.

46 - Snowdon, R., W. Lühs and W. Friedt,(2006). Brassica oilseeds. In: Ram, J.S. (Editor), Genetic resources,chromosome engineering, and crop improvement: Oilseed crops, 4th edition. CRC, p. 196-222.

47 – Sultan , S . M . Mohammad , M . A . and AbodieT . S . (1985). Effect of seeding rate and phosphorus fertilizer on rape seed under rain fed condition of Hamman Al-Alil. Iraq Zanco.3(4):91-102.

48 - Taylor AJ, Smith CJ (1992). Effect of sowing data and seeding rate on yield components of irrigated canola (Brassica napus L.) grown on a red-brown earth in south-eastern Australia. Australian Journal Agricultural Research 43: 1629-1641.

49 - Uddin,M.M.A.,Samad,M.R.,Khan,S.Begum and M.A. Salam(1986). Effect of sowing dates on yield and some of its components of mustard and rapeseed . Bang . J . Sci . 21 : 159 -166.

50 - USDA, (2008) Oilseeds: World Markets and Trade. United States Department of Agriculture.

51 - Uzun B, Zengin U, Furat S and Akdesir O (2009). Sowing date effects on growth flowering, seed yield and oil content of canola cultivars. Asian Journal of Chemistry 21: 1957-1965.

52 - VanDeyze, A.E, Mc Vetty , P.B, Scarth, R. and Rimmer, S.R.(1992). Effect of varying seeding rates on hybrid and conventional summer rape performance in Manitoba. Can. J. Plant Sci., 72,635-641.

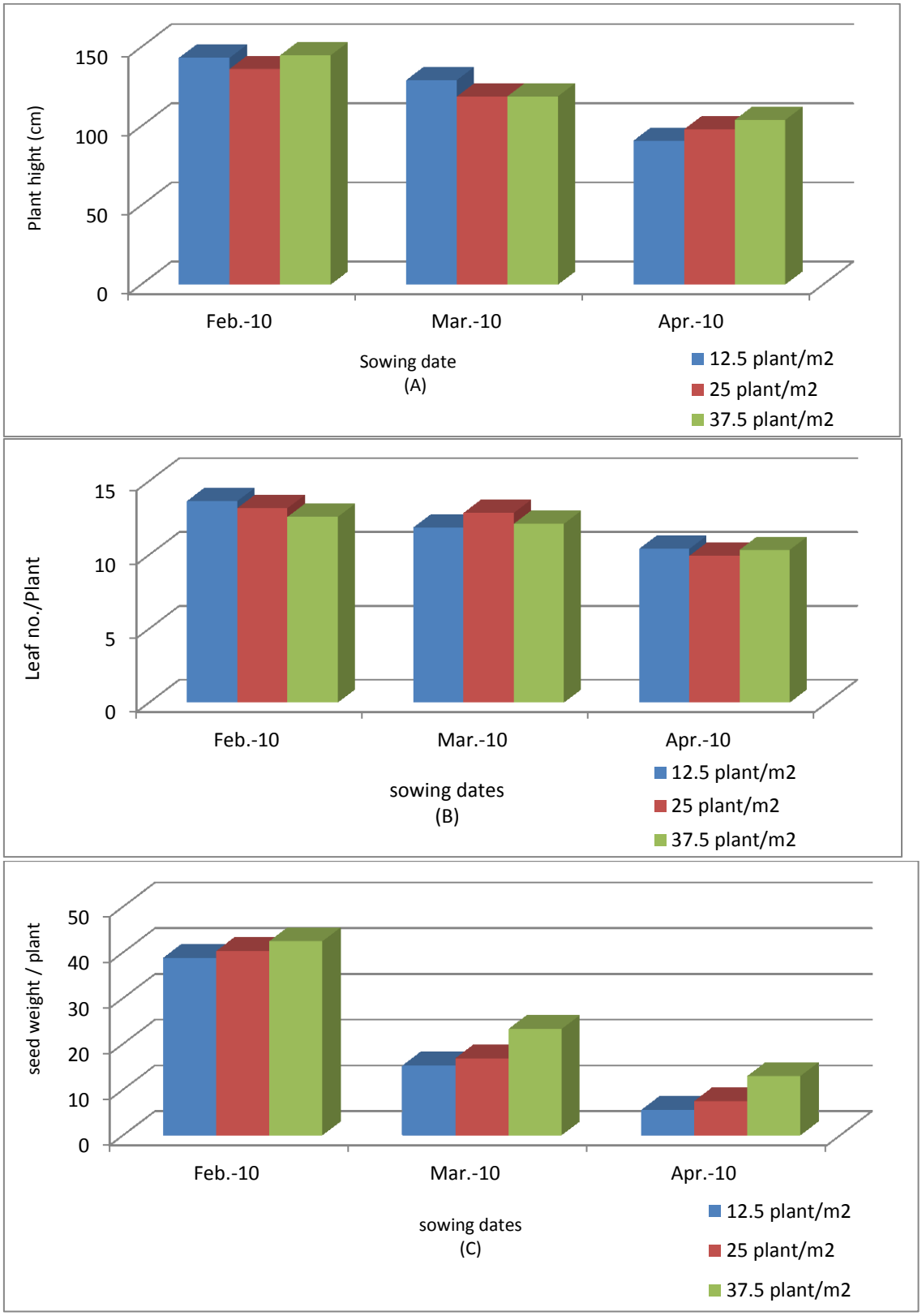

Figure (1): Comparison of the mean of plant height (A) ,(B) leafs no/plant and (C) seed weight /plant) as affected by the sowing date and plant density

تأثير مواعيد الزراعة والكثافة النباتية في بعض الصفات المورفولوجية ، ومكونات الحاصل لنبات الكانولا (Brassica napus L)

عبده بكري فقيره خلود محمد الضبيبي

الملخص

أجريت هذه الدراسة في مزرعة كلية الزراعة البحثية التابعة لجامعة صنعاء خلال موسم 2013م بهدف دراسة تأثير. ثلاثة مواعيد زراعية مختلفة ،(10 فبراير ، 10 مارس ، 10 أبريل) وثلاثة مستويات من الكثافة النباتية (12.5 و25 و 37.5 نبات/م^2) في بعض الصفات المورفولوجية ، ومكونات الحاصل لنبات الكانولا صنف Pactole أظهرت نتائج التجربة وجود فروقات معنوية بين مواعيد الزراعة المختلفة وتأثير ذلك في صفات كل من ارتفاع النبات وعدد الأوراق/ نبات وكذلك وزن البذور/ نبات عند موعد الزراعة 10 فبراير الذي أعطى أعلى قيمة معنوية لهذه الصفات مقارنة مع نباتات الكانولا النامية تحت ارتفاع درجة الحرارة خلال موعد 10 أبريل والتي أعطت أقل قيم لهذه الصفات. وتوضح نتائج معاملات مواعيد الزراعة المختلفة انعدام التأثير المعنوي في صفات كل من وزن 1000 بذرة ، وكذلك صفات حاصل البذور. وتشير النتائج إلى انعدام التأثير المعنوي لكثافة النباتات المختلفة في كل من ارتفاع النبات ، عدد الأوراق / نبات ، وزن البذور/ نبات وكذلك صفات حاصل البذور. تشير النتائج وجود تداخل بين مواعيد الزراعة ، والكثافة النباتية في صفات ارتفاع النبات ، عدد الأوراق / نبات ، وزن بذور النبات ، وزن 1000 بذرة . نستخلص من هده الدراسة أنَّ نبات الكانولا كان له القدرة على الاستجابة تحت تأثير مواعيد الزراعة والكثافة النباتية المختلفة تحت ظروف صنعاء ، ونوصي بمزيد من البحوث والدراسات في مناطق لهذا المحصول الزيتي المهم .

الكلمات المفتاحية: نبات الكانولا – مواعيد زراعة – كثافة نباتية – اليمن.