RESPONSE OF SUGAR BEET TO PLANTING DATE AND NUMBER OF DAYS TO HARVEST UNDER NORTH SINAI CONDITIONS

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Abstract

Two field experiments were conducted in a sandy soil at a private farm at North Sinai region during 200/2004 and 2004/2005 seasons to study the effect of three planting dates (15/8, 15/9 and 15/10) and three harvesting dates (175, 190 and 205 days after planting) on yield and quality of six sugar beet cultivars (Pamela, Hipoly2, Pleno, Monte Bianco, Oscar poly and Gloria).

Planting dates significantly affected sucrose and purity percentages, as well as, root and sugar yields/fed. in both seasons. The highest root and sugar yield were obtained from the 15th Sept. planting.

Harvesting after 205 days from planting recorded the highest root weight, sucrose and purity percentages as well as root and sugar yields/fed.

Sugar beet cultivars differed significantly in all traits under study. Oscar poly variety recorded the highest root yield but, Monte Bianco cultivar surpassed all cultivars in sugar yield.

The interaction between each two factors under study was insignificant.

The response equation of root yield/fed to delaying harvest showed diminishing returns. A higher predicted root yield than that retained herein, could have been obtained if harvest was delayed beyond 205 days after planting.

INTRODUCTION

Sugar beet (*Beta vulgaris*, L.) is considered to be a prospective crop in Egypt. Improving its productivity is an urgent demand to meet the consumption of the ever growing population. Selecting the promising cultivars and their suitable times for planting and harvesting are among the most important factors affecting sugar beet production.

Under the environmental conditions of Egypt, many investigators have studied planting date effect on yield and quality of sugar beet. There is a general agreement that planting on October or September give the highest sucrose percentage as well as root and sugar yields/fed. (Hassanin 1999 and Mokadem 1999).

Sugar beet production greatly fluctuates according to the cultivars because of the variation in root yield (Lauer 1997, and Ramadan 1999) and sucrose percentage (Ramadan and Hassanin, 1999 and Abd El-Razek 2003).

Suitable time for harvesting sugar beet materially affects the yield of root and sugar. In this concern, (Saif *et al.* 1997, Ramadan 1999 and Abd El-Razek 2003) reported that, the maximum root and sugar yield/fed. were obtained when sugar beet was harvested after 6 to 7 months from planting. Ramadan, (1999) found that harvesting sugar beet after 210 days from planting decreased impurities in terms of Na, K and Alfha amino-N.

Finally (Badawi and El-Mursy 1997, Abd El-Rahim 1998, Mokadem 1999 and Ramadan and Hassanin 1999) found that varying cultivars and harvesting times affected greatly sucrose and juice purity percentages, root yield and sucrose yield. The highest root yield/fed. was obtained from Pleno cultivar when harvested after 6.5 and 7 months from planting. (Saif *et al.* 1997) reported that harvesting times had measurable effects on root weight, root sucrose content as well as root and sugar yields/fed. (Ramadan and Hassanin 1999) showed that sugar beet cultivars markedly differed in their potential yield. Harvesting after 200 days from planting was the proper time to obtain the highest sucrose and juice purity percentages as well as root and sucrose yields/fed. (Saif *et al.* 1997) pointed out that delaying harvesting to 210 day from planting significantly increased root diameter, root fresh weight/plant, total soluble solid percentage, sucrose percentage and root and sugar yields.

Therefore, the present investigation was devoted to study the effect of planting and harvesting times on yield and quality of certain sugar beet cultivars under North Sinai conditions.

MATERIALS AND METHODS

Two field experiments were conducted in a sandy soil of a private farm in North Sinai during 2003/2004 and 2004/2005 seasons to find out the response of six sugar beet cultivars (Pamela, Hipoly2, Pleno, Monte Bianco

Oscar poly and Gloria) to three planting dates (i. e., Aug. 15th, Sep. 15th and Oct. 15th.) and number of days to harvest (175, 190 and 205 days after planting). A split-split plot design with four replications was used. The main plots were assigned to the three planting dates. The sub plots were devoted to the number of days to harvest. The six tested cultivars were randomly distributed in sub-sub plots. Each plot consisted of five ridges 3.5 meters long and 60 cm apart. The area of each sub-sub plot was 10.5m^2 i.e. 1/400fed. The soil texture of the experimental farm was sandy soil.

Planting was on one side of ridges with hill spacing of 20cm where plots were irrigated immediately after planting. Calcium super phosphate (15.5% p_2o_5) at rate of 200kg/fed. was added during seed bed preparation. Potassium sulphate (48% k_2o) was applied at rate of 48kg/fed. after thinning. Nitrogen fertilizer in the form of ammonium nitrate (33.5%N) was split in five splits given after thinning and 15, 30, 40, and 60 days later. Sugar beet plants were thinned to one plant/hill when plants had four true leaves (after 40 days from planting). The other agronomic practices were applied as recommended.

At harvest, ten plants were taken at random to determine root length, root diameter and root weight/plant. Root yield/fed was datrmined from the three central ridges.

The juice of ten roots was extracted to determine the following juice quality characters:

1- Sucrose percentage (Pol %).
2- Impurities (Na, K and alpha amino-N).
3- Purity percentage.
4- Sugar loss in molasses percentage(SM %).
5- Extractable sugar percentage.
6- Extractability percentage.

An automatic French system (HYCEL) for beet quality analysis was used and quality parameters were determined as follows:

Sugar percentage (Pol %) was polarimetrically determined on a lead acetate of fresh macerated root according to the method of Le-Docte (1927). Meantime, the extract was used to determine beet impurities, which include:

1- Sodium and potassium (Flame Photometry).
2- Alpha amino-N determined (Hydrindnation method) according to Carruthers *et al.* (1962).

Purity, sugar loss in molasses (SM)%, extractable sugar percentage (Rendment or recovery), extractability % (Extractable coefficient) were calculated according to the following formulae:

Purity %=$99.36-14.27(V_1+V_2+V_3)/V_4$ (Devillers, 1988).

Sugar extraction=V4- SM-0.6(Dexter *et al.* 1967).

Extratability %= Sugar extraction/ Pol %

Where: V1 Sodium V3 Alpha amino-N

V2 Potassium V4 POl%

Sugar yield ton/fed. = root yield (ton/fed.) x adjusted sucrose percentage.

Data collected of both seasons were statistically analyzed according to Snedecor and Cochran (1980).Treatment means were compared using LSD test at 0.05 level of probability (Waller and Duncan, 1969).

RESULTS AND DISCUSSION

A-Root characteristics: (Root length, diameter and weight):

Data presented in Table (1) show the effect of sowing dates on root length, diameter and weight. The results indicate that planting dates exhibited a significant effect on root characters in both seasons. Where root length was decreased with delaying planting date beyond Aug15th. The thickest root diameter and heaviest root weight were recorded for planting on Sep15th. While late planting at 15th Oct recorded the lowest values of these parameters. Similar results were obtained by Hassanin (1999) and Mokadem (1999).

Data in Table (1) show that delaying harvest from 175 to 205 days after planting had a significant effect on root length, diameter and weight in both seasons. Delaying harvest of sugar beet to 205 instead 175 days after planting increased beet root length from 24.6cm to 28.0cm in first season and from 26.6cm to 30.6cm in second season. Also, root diameter was increased from 10.5cm to 12.7cm and from 10.8 to 12.6cm in first and second seasons, respectively. Moreover, root weight was increased from 617g to 804g and from 641g to 802g in first and second seasons, respectively. Such effect of harvesting dates might be due to more dry matter accumulation in root with delaying harvesting. These results are in agreement with results obtained by Saif *et al.* (1997) and Abd El-Razek(2003).

Significant differences were observed among sugar beet cultivars in root length, diameter and weight in both seasons (Table 1). Pleno cultivar recorded the highest root length, while, Oscar poly cultivar gave the thickest root diameter and heavier root weight in both seasons. These differences are due to differences their genetic constituents. These results are in harmony with those reported by Badawi and El-Moursy (1997), Mokadem (1999) and AbdEl-Razek(2003).

B- Sugar quality traits [Sucrose%, Purity% and Total soluble solid % (TSS %)]:

Planting dates exhibited significant effect on sucrose, purity and total soluble solid percentages in both seasons (Table 2). Planting sugar beet in Aug 15th produced the highest averages of sucrose being 17.8% and 17.7% and TSS percentages 22.1% and 21.7% in first season and second season respectively. The lowest values of these traits were obtained from planting at the latest date (15th October). On other hand,

Table 1. Root length, diameter and weight as affected by date of planting and number of days to harvest for the six sugar beet cultivars and their interaction in the two seasons.

Sowing Dates	Variety	*Days to harvest*																							
		Root length (cm)								Root diameter (cm)								*Root weight (g)*							
		2003/2004				2004/2005				2003/2004				2004/2005				2003/2004				*2004/2005*			
		175	190	205	Mean	175	190	205	Mean	175	190	205	Mean	175	190	205	Mean	175	190	205	mean	175	190	205	*Mean*
15 Aug	Pamela	24.7	27.3	27.5	26.5	25.3	27.8	29.1	27.4	10.4	11.9	12.8	11.7	10.8	11.9	12.5	11.7	598	719	803	707	630	751	820	*734*
	Hi poly	25.2	27.3	28.5	27.0	28.2	31.7	33.5	31.1	9.8	11.1	12.1	11.0	10.2	11.3	11.9	11.1	553	670	715	646	600	657	710	*656*
	Pleno	26.3	29.7	30.5	28.8	30.1	34.5	36.8	33.8	10.2	11.1	11.9	11.1	10.0	11.4	12.0	11.1	606	740	816	721	645	757	845	*749*
	M.Bianco	27.3	30.4	31.6	29.8	29.7	33.9	35.2	32.9	9.5	11.4	12.1	11.0	10.6	12.6	13.0	12.1	599	726	768	698	610	735	785	*710*
	Oscarpoly	25.2	28.7	29.5	27.8	26.8	29.5	31.1	29.1	10.6	12.4	13.3	12.1	11.3	12.6	13.1	12.3	520	764	838	741	647	782	865	*765*
	Gloria	24.5	26.7	27.8	26.3	26.3	29.2	30.6	28.7	10.3	11.8	12.9	11.7	10.8	11.6	12.5	11.6	563	685	731	659	615	685	779	*693*
	Mean	25.5	28.4	29.2	27.7	27.7	31.1	32.7	30.5	10.1	11.6	12.5	11.4	10.6	11.9	12.5	11.7	590	717	778	695	625	728	801	*718*
15 Sep	Pamela	23.5	25.7	26.8	25.3	24.2	26.3	27.0	25.8	11.7	13.4	14.2	13.1	12.3	13.1	13.9	13.1	711	831	908	817	753	864	901	*833*
	Hi poly	24.8	26.3	27.3	26.2	26.8	29.3	30.8	28.9	11.2	12.8	13.1	12.4	11.0	12.1	12.8	11.9	672	790	838	767	645	705	791	*714*
	Pleno	25.6	28.3	29.6	27.8	29.8	33.2	34.7	32.6	11.6	12.8	13.2	12.5	10.7	11.8	12.6	11.7	717	850	915	828	733	862	920	*838*
	M.Bianco	25.1	28.7	29.0	27.6	28.3	30.7	32.5	30.5	11.3	12.8	13.7	12.6	11.8	12.9	13.8	12.8	728	843	878	816	727	793	850	*790*
	Oscarpoly	24.3	26.7	26.8	25.9	26.2	28.7	27.9	27.62	12.3	13.8	14.6	13.6	12.7	13.6	14.2	13.5	735	897	976	869	747	870	952	*856*
	Gloria	23.4	25.6	27.2	25.4	25.1	27.6	28.3	27.0	11.9	13.2	13.7	12.9	11.5	12.7	13.6	12.6	686	795	855	779	705	773	820	*766*
	Mean	24.5	26.9	27.8	26.4	26.7	29.3	30.2	28.8	11.7	13.1	13.8	12.9	11.7	12.7	13.5	12.6	708	834	895	813	718	808	872	*800*
15 Oct	Pamela	23.5	25.4	25.6	24.8	23.5	25.7	26.8	25.3	9.8	11.3	12.2	11.1	10.2	11.4	12.3	11.3	541	665	751	652	585	692	727	*668*
	Hi poly	23.9	25.5	26.7	25.4	24.6	26.4	28.2	26.4	9.3	10.6	11.7	10.5	9.7	11.2	11.5	10.8	524	621	679	608	550	610	685	*615*
	Pleno	23.5	27.7	28.6	26.6	28.7	31.3	33.1	31.3	9.6	10.4	11.5	10.5	9.3	10.7	11.5	10.5	563	697	765	675	607	683	736	*675*
	M.Bianco	245	27.6	28.3	26.8	26.0	29.2	30.7	28.6	9.1	10.8	11.5	10.5	10.5	11.2	11.8	11.2	531	660	732	641	570	680	713	*654*
	Oscarpoly	23.7	26.2	26.5	25.4	25.8	26.4	27.8	26.7	9.8	11.8	12.7	11.4	10.5	11.8	12.5	11.6	574	721	803	700	610	736	810	*719*
	Gloria	23.1	25.8	26.4	25.1	23.6	26.4	27.3	25.8	9.7	11.2	11.8	10.9	10.2	11.0	11.7	10.9	577	632	698	636	560	620	725	*635*
	Mean	23.7	26.4	27.0	25.7	25.4	27.6	28.9	27.3	9.6	11.0	11.9	10.8	10.1	11.2	11.9	11.1	552	666	738	652	580	670	733	*661*
Mean		24.6	27.2	28.0	26.6	26.6	29.3	30.6	28.9	10.5	11.9	12.7	11.7	10.8	11.9	12.6	11.8	617	739	804	712	641	735	802	*726*
L.S.D. at 0.05 level	:																								
Sowing dates (S)	:				0.96				1.62				0.48				0.65				2.43				*1.77*
Harvesting dates (H)	:				1.42				0.93				0.36				0.30				2.13				*2.43*
Varieties (V)	:				1.15				0.83				0.34				0.40				3.02				*1.88*
SxH	:				NS				NS				NS				NS				NS				*NS*
Sxv	:				NS				NS				NS				NS				NS				*NS*
HxV	:				NS				NS				NS				NS				NS				*NS*
SxHxV	:				*NS*				*NS*				*NS*				*NS*				*NS*				*NS*

delaying planting date to Oct 15th decreased purity% from 81.6 to 79.1 in the first season and from 83.3 to 80.4% in the second season. These results are in harmony with those obtained by Lauer (1997), Abd El-Rahim (1998), Mokadem (1999) and Ramadan and Hassanin (1999).

Data in Table (2) present the effect of harvesting dates on quality traits in 200/2004 and 2004/2005 seasons. The data revealed that there was a gradual and significant increases in quality traits values with the advance in plant age up to 205 days after planting. The data revealed that delaying harvest from 175 to 205 days after planting increased sucrose % from 15.6 to 17.9 in first season and from 15.9 to 18.0 in second season. This delay increased purity percentage from 78.8 to 81.8 in first season and from 80.3 to 83.3 in second season. Similar increase was seen in TSS% values with delaying harvest (19.8 to 21.8 in first season and from 19.9 to 21.7 in second season). Such effect of delaying harvest up to 205 days after planting might have been due to extending of the growing period and consequently an expected increase in translocation of assimilates from leaves to roots which was then reflected in sucrose percentage. These results are in agreement with Lauer(1997), saif *et al.*(1997) and Abd El-Razek (2003).

Differences among cultivars in quality traits were significant in both seasons (Table 2). The variation in quality traits of the studied cultivars is certainly due to their variation in genetic back ground. The highest of sucrose and purity percentages were obtained from Monte Bianco and Hi poly 2 cultivars respectively, in both seasons. While, the lowest sucrose percentage resulted from Pleno cultivar in both seasons. However the lowest purity percentage was recorded for Pleno cultivar. However Monte Bianco cultivar had the highest of TSS% whereas, Gloria cultivar had lowest one in both seasons. Similar results were reported by Lauer(1997), Abd El-Rahim (1998), Mokadem (1999), Ramadan and Hassanin (1999) and Abd El-Razek (2003).

C- Juice impurities:

C-1- Sodium, potassium, amino-N contents:

Data presented in Table (3) show the effect of planting dates on juice impurities (Na, K and amino-N) in the two seasons. Delaying planting date increased juice impurities components expressed as Na, K and amino–N contents. This was more pronounced in October planting where most of the ripening period was during (May) where high temperature might enhanced nutrient uptake. Delaying planting may, therefore, be reflected in having low purity percentage. These results are in agreement with those reported by Lauer (1997).

Table 2. Sucrose%, purity% and total soluble solid (TSS%) as affected by date of planting and number of days to harvest for the six sugar beet cultivars and their interaction in the two seasons.

Sowing Dates	Variety	*days to harvest*																							
		Sucrose%								Purity%								*T.S.S.%*							
		2003/2004				2004/2005				2003/2004				2004/2005				2003/2004				*2004/2005*			
		175	190	205	Mean	175	190	205	Mean	175	190	205	Mean	175	190	205	Mean	175	190	205	mean	175	190	205	*Mean*
15 Aug	Pamela	15.8	17.2	17.9	16.9	16.0	16.4	17.6	16.7	77.2	78.8	80.5	78.8	79.7	81.5	83.2	81.5	20.7	22.3	22.6	21.9	19.7	20.6	21.6	*20.6*
	Hi poly	17.2	18.8	19.7	18.6	17.3	18.6	20.2	18.7	86.5	88.2	89.7	88.1	88.7	90.2	91.4	90.1	20.1	21.6	22.3	21.4	19.9	21.3	22.8	*21.3*
	Pleno	15.5	16.9	17.6	16.7	15.9	16.5	17.2	16.5	76.2	78.0	79.2	77.8	75.5	77.3	78.5	77.1	20.6	22.2	22.7	21.8	21.3	21.7	22.2	*21.7*
	M.Bianco	17.3	19.4	20.1	18.9	17.3	19.9	21.4	19.5	79.1	80.9	82.8	80.8	82.4	83.8	85.7	83.9	22.3	24.2	24.5	23.7	21.4	24.2	25.7	*23.8*
	Oscarpoly	16.3	17.8	18.4	17.5	16.2	17.3	18.1	17.2	76.8	78.2	79.6	78.2	77.2	78.7	80.8	78.9	21.6	23.2	23.5	22.8	21.5	22.3	22.9	*22.2*
	Gloria	16.7	18.2	18.9	17.9	16.5	17.8	18.6	17.6	84.7	85.8	87.1	85.9	86.2	87.6	90.3	88.0	19.9	21.4	22.0	21.1	19.3	20.7	21.0	*20.3*
	Mean	16.5	18.1	18.8	17.8	16.5	17.8	18.9	17.7	80.1	81.7	83.1	81.6	81.6	83.2	85.0	83.3	20.9	22.5	22.9	22.1	20.5	21.8	22.7	*21.7*
15 Sep	Pamela	14.6	15.8	16.8	15.7	15.2	15.9	17.0	16.0	76.3	77.2	79.2	77.6	77.6	79.8	81.4	79.6	18.9	20.1	20.8	19.9	19.1	19.5	20.4	*19.7*
	Hi poly	16.1	17.7	18.9	17.5	16.7	17.9	19.5	18.0	85.6	86.9	88.2	86.9	86.8	87.5	88.8	87.7	18.7	20.1	20.7	19.8	18.8	19.9	21.4	*20.0*
	Pleno	14.5	15.7	16.7	15.5	15.3	16.1	16.6	16.0	75.1	76.2	77.6	76.3	74.7	76.2	77.6	76.2	19.1	20.1	21.1	10.1	20.3	20.8	21.1	*20.7*
	M.Bianco	16.6	18.5	19.2	18.1	16.8	18.2	19.7	18.2	77.6	79.7	81.1	79.5	80.7	82.2	83.4	82.1	21.0	22.9	23.3	22.4	20.4	21.7	23.0	*21.7*
	Oscarpoly	15.2	16.3	17.2	16.2	15.5	16.5	17.5	16.5	75.4	76.7	78.3	76.8	75.4	77.6	79.2	77.4	19.8	20.8	21.6	20.7	20.0	20.9	21.7	*20.9*
	Gloria	15.5	16.9	17.8	16.7	15.9	16.4	17.9	16.7	83.6	84.8	86.0	84.8	85.4	86.1	88.7	86.7	18.3	19.7	20.4	19.5	18.4	18.7	19.8	*19.0*
	Mean	15.4	16.8	17.7	16.7	15.9	16.8	18.0	16.9	78.9	80.3	81.7	80.3	80.1	81.6	83.2	81.6	19.3	20.6	21.3	20.4	19.5	20.3	21.2	*20.3*
15 Oct	Pamela	14.2	15.3	16.1	15.2	14.9	15.3	16.4	15.5	74.5	76.1	78.3	76.3	77.1	77.8	79.3	78.1	19.1	20.1	20.6	19.2	19.3	19.7	20.7	*19.9*
	Hi poly	15.4	16.8	17.9	16.7	15.7	16.4	18.1	16.7	84.5	85.8	87.4	85.9	85.7	86.3	87.2	86.4	18.2	19.6	20.5	19.4	18.3	19.0	20.8	*19.4*
	Pleno	14.1	15.2	16.0	15.1	15.0	15.4	16.1	15.5	73.5	74.8	76.2	74.8	73.5	75.6	76.4	75.2	19.2	20.3	21.0	20.2	20.4	20.4	21.1	*20.6*
	M.Bianco	16.1	17.6	18.5	17.4	16.5	17.8	18.2	17.5	76.5	78.6	80.3	78.5	79.2	81.0	82.3	83.8	21.0	22.4	23.0	22.1	20.8	22.1	22.1	*21.7*
	Oscarpoly	14.6	15.5	16.7	15.6	15.1	15.8	16.9	15.9	74.1	75.3	77.0	75.5	75.2	76.8	77.5	76.5	19.7	20.6	21.7	20.7	20.1	20.6	21.8	*20.8*
	Gloria	15.1	16.0	17.2	16.1	15.3	15.6	17.0	16.0	81.7	83.4	85.2	83.4	84.3	84.8	87.4	85.5	18.5	19.2	20.2	19.3	18.1	18.5	19.8	*18.8*
	Mean	14.9	16.1	17.1	16.0	15.4	16.1	17.1	16.2	77.5	79.0	80.7	79.1	79.3	80.3	81.7	80.4	19.3	20.3	21.2	20.3	19.5	20.0	21.0	*20.2*
Mean		15.6	16.9	17.9	16.8	15.9	16.9	18.0	16.9	78.8	80.3	81.8	80.3	80.3	81.7	83.3	81.8	19.8	21.2	21.8	20.9	19.9	20.7	21.7	*20.7*
L.S.D. at 0.05 level	:																								
Sowing dates (S)	:				0.21				0.61				0.45				0.80				0.26				*0.76*
Harvesting dates (H)	:				0.23				0.31				0.61				0.83				0.28				*0.52*
Varieties (V)	:				0.20				0.29				0.55				0.66				0.27				*0.40*
SxH	:				NS				NS				NS				NS				NS				*NS*
Sxv	:				NS				NS				NS				NS				NS				*NS*
HxV	:				NS				NS				NS				NS				NS				*NS*
SxHxV	:				*NS*				*NS*				*NS*				*NS*				*NS*				*NS*

Days to Harvest exhibited significant effects on juice impurities (Table 3). The highest impurities were detected for early harvest i.e. after 175 days from planting. Thereafter gradual and noticeable reduction in these traits was recorded as harvesting was delayed to 205 days after planting. These results are in line with those reported by Ramadan (1999).

Data in Table (3) reveal significant differences among sugar beet cultivars in juice impurities in both seasons. The highest values of impurities in terms of Na, K and amino-N were obtained from Pleno cultivar in the first and second seasons. But the lowest values of these traits were obtained from Hi poly2 in both seasons. These results are in agreement with those obtained by Lauer (1997) .

C-2- Sucrose loss in molasses:

Planting date exhibited significant effects on sucrose loss in molasses in both seasons (Table 4). Delaying planting date increased sucrose loss from 1.96 for Aug 15th planting to 2.22 for Oct15th planting in first season and from 1.94 to 2.17 in second season. Such effect of planting date may be attributed to the increase of impurities in terms of Na, K and amino-N (Table 3) as well as reduction in sucrose and purity percentage. These results are in agreement with those obtained by Lauer (1997).

Delaying harvest from 175 to 205 days after planting reduced sucrose loss in molasses from 2.19 to 1.95 in first season and from 2.15 to 1.96 in second one (Table 4). Such effect may be due to the gradual decrease in the three main impurities i.e. Na, K and amino-N with the advance of plant age up to 205 days after planting. These results are in harmony with those obtained by Lauer (1997).

Sucrose loss in molasses was significantly different among cultivars in both seasons (Table 4). The highest value of sucrose loss in molasses was obtained from Pleno. Whereas the lowest value was obtained from Hi poly2 cultivar in both seasons. These results are in harmony with those obtained by Lauer (1997).

D- Sugar extraction percentage and extractability:

Planting dates exhibited significant effect on sugar extraction percentage and extractability in both seasons (Table 4). The highest values of both traits resulted from Sept. planting in both seasons followed by August. planting. October planting decreased both traits in both seasons. Therefore, the highest reduction in extractability was observed for Oct. planting in both seasons. Such effect may be due that Oct. planting exhibited significant decrease in sucrose and purity percentages (Table 2) when was accompanied by a high sugar loss in molasses (Table 4).

Table 3. Na, K and amini-N as affected by date of planting and number of days to harvest for the six sugar beet cultivars and their interaction in the two seasons.

Sowing Dates	Variety	days to harvest																							
		Na%								K%								Amino- N%							
		2003/2004				2004/2005				2003/2004				2004/2005				2003/2004				2004/2005			
		175	190	205	Mean	175	190	205	Mean	175	190	205	Mean	175	190	205	Mean	175	190	205	mean	175	190	205	Mean
15 Aug	Pamela	2.48	2.15	1.90	2.18	2.41	2.27	2.10	2.26	3.75	3.52	3.40	3.56	3.38	3.21	2.96	3.18	3.14	2.95	2.82	2.98	3.05	2.97	2.82	*2.95*
	Hi poly	1.90	1.64	1.47	1.67	1.87	1.68	1.52	1.69	3.11	2.93	2.61	2.88	2.96	2.95	2.45	2.79	2.63	2.40	2.21	2.41	2.56	2.48	2.30	*2.45*
	Pleno	2.75	2.31	1.97	2.34	2.46	2.05	2.18	2.23	3.85	3.71	3.47	3.68	3.52	3.40	3.16	3.36	3.30	3.17	2.99	3.15	3.35	3.28	3.15	*3.26*
	M.Bianco	2.42	2.25	1.81	2.16	2.28	2.13	2.91	2.11	3.85	3.60	3.27	3.57	3.39	3.32	3.07	3.26	2.95	2.88	2.75	2.86	3.27	3.14	2.91	*3.11*
	Oscarpoly	2.26	1.95	1.77	1.99	2.11	1.88	1.72	1.90	3.65	3.25	2.87	3.26	3.20	2.97	2.82	3.00	2.86	2.68	2.54	2.69	2.95	2.81	2.63	*2.80*
	Gloria	2.13	1.81	1.68	1.87	2.27	1.96	1.78	2.00	3.72	3.48	2.96	3.39	3.48	3.26	2.95	3.23	2.77	2.58	2.40	2.58	2.82	2.67	2.51	*2.67*
	Mean	2.32	2.02	1.77	2.04	2.23	1.99	1.87	2.03	3.66	3.42	3.10	3.39	3.32	3.19	2.90	3.14	2.94	2.78	2.63	2.78.	3.00	2.89	2.72	*2.87*
15 Sep	Pamela	2.71	2.46	2.15	2.44	2.62	2.50	2.27	2.46	4.11	2.86	3.70	3.89	3.95	3.70	3.52	3.72	3.32	3.17	2.94	3.14	3.25	2.97	2.82	*3.01*
	Hi poly	2.25	1.82	1.66	1.91	2.18	1.87	1.74	1.93	3.40	3.21	2.97	3.19	3.24	2.93	2.78	2.98	2.75	2.58	2.45	2.59	2.71	2.63	2.41	*2.58*
	Pleno	2.92	2.60	2.25	2.59	2.83	2.68	2.31	2.61	4.20	3.97	3.81	3.99	4.37	4.15	3.92	4.15	3.39	3.26	2.98	3.21	3.42	3.37	3.21	*3.33*
	M.Bianco	2.60	2.48	2.11	2.40	2.55	2.37	2.18	2.37	3.97	3.85	3.41	3.74	4.17	3.94	3.76	3.96	3.18	2.96	2.73	2.96	3.30	3.17	3.28	*3.25*
	Oscarpoly	2.47	2.35	1.90	2.24	2.40	2.13	1.85	2.13	3.81	3.47	3.02	3.43	3.53	3.21	2.93	3.22	2.95	2.83	2.68	2.82	2.91	2.85	2.71	*2.82*
	Gloria	2.32	2.10	1.77	2.06	2.45	2.27	1.92	2.21	3.80	3.63	3.15	3.53	3.71	3.45	3.20	3.45	2.86	2.71	2.57	2.71	2.92	2.80	2.67	*2.80*
	Mean	2.55	2.30	1.97	2.27	2.51	2.30	2.05	2.28	3.88	3.67	3.34	3.63	3.83	3.56	3.35	3.58	3.08	2.92	2.73	2.91	3.09	2.97	2.85	*2.97*
15 Oct	Pamela	2.95	2.47	2.26	2.56	2.86	2.73	2.31	2.63	4.30	4.21	3.97	4.16	4.20	3.92	3.76	3.96	3.78	3.63	3.41	3.61	3.46	3.37	3.22	*3.35*
	Hi poly	2.43	2.00	1.87	2.10	2.37	2.21	1.92	2.17	3.68	3.52	3.17	3.46	3.54	3.22	2.96	3.24	2.94	2.85	2.71	2.83	2.86	2.78	2.64	*2.76*
	Pleno	3.11	2.65	2.44	2.73	2.97	2.78	2.40	2.72	4.48	4.34	3.10	4.31	4.40	4.22	4.05	4.22	3.97	3.83	3.65	3.82	3.68	3.57	3.42	*3.56*
	M.Bianco	2.90	2.48	2.22	2.53	2.72	2.60	2.24	2.52	4.17	3.95	3.80	3.97	4.37	3.98	3.85	4.07	3.52	3.38	3.25	3.38	4.80	3.41	3.23	*3.37*
	Oscarpoly	2.77	2.45	2.10	2.44	2.50	2.41	1.97	2.29	3.80	3.71	3.32	3.61	3.70	3.41	3.23	3.45	3.38	3.54	2.94	3.29	326	3.17	3.11	*3.18*
	Gloria	2.60	2.32	1.94	2.29	2.64	2.53	2.06	2.41	3.97	3.80	3.53	3.77	3.92	3.68	3.47	3.69	3.25	2.98	2.86	3.03	3.18	2.97	2.82	*2.99*
	Mean	2.79	2.40	2.14	2.44	2.68	2.54	2.15	2.46	4.07	3.92	3.65	3.88	4.02	3.74	3.55	3.99	3.47	3.37	3.14	3.33	3.32	3.21	3.07	*3.20*
Mean		2.55	2.24	1.96	2.25	2.47	2.28	2.02	2.26	3.87	3.67	3.36	3.63	3.72	3.50	3.27	3.50	3.16	3.02	2.82	3.01	3.14	3.02	2.88	*3.01*

L.S.D. at 0.05 level :						
Sowing dates (S) :	0.34	0.20	0.10	0.24	0.09	*0.38*
Harvesting dates (H):	0.10	0.12	0.14	0.21	0.17	*0.25*
Varieties (V):	0.07	0.09	0.10	0.13	0.10	*0.14*
SxH :	NS	NS	NS	NS	NS	*NS*
Sxv :	NS	NS	NS	NS	NS	*NS*
HxV :	NS	NS	NS	NS	NS	*NS*
SxHxV :	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Table 4. Sucrose loss%(Ms), extraction% and extractability% as affected by date of planting and number of days to harvest for the six sugar beet cultivars and their interaction in the two seasons.

Sowing Dates	Variety	*days to harvest*																							
		Ms%								Extraction%								*Extractability%*							
		2003/2004				2004/2005				2003/2004				2004/2005				2003/2004				*2004/2005*			
		175	190	205	Mean	175	190	205	Mean	175	190	205	Mean	175	190	205	Mean	175	190	205	mean	175	190	205	*Mean*
15 Aug	Pamela	2.16	2.03	1.96	2.05	2.07	2.01	1.91	2.00	11.8	13.2	14.2	13.1	12.5	13.3	14.5	13.4	81.1	83.3	84.8	83.1	82.4	83.6	85.2	*83.7*
	Hi poly	1.86	1.74	1.62	1.74	1.82	1.77	1.63	1.74	13.7	15.4	16.4	15.1	14.3	15.5	17.3	15.7	84.8	86.8	88.0	86.5	85.5	86.8	88.6	*86.9*
	Pleno	2.25	2.14	2.01	2.13	2.18	2.08	2.04	2.10	11.7	12.9	14.1	12.9	12.5	13.4	13.9	13.3	80.3	82.6	84.4	82.4	81.8	83.3	84.1	*83.1*
	M.Bianco	2.12	2.04	1.90	2.02	2.11	2.05	1.93	2.03	13.9	15.9	16.7	15.5	14.1	15.6	17.2	15.6	83.6	85.7	86.9	85.4	83.9	85.4	87.1	*85.5*
	Oscarpoly	2.04	1.90	1.79	1.91	1.98	1.88	1.79	1.89	12.6	13.8	14.8	13.7	12.9	14.0	15.1	14.0	82.6	84.7	86.1	84.5	83.3	84.9	86.3	*84.9*
	Gloria	2.01	1.89	1.75	1.88	2.01	1.90	1.79	1.90	12.9	14.4	15.5	14.3	13.3	13.9	15.5	14.2	83.1	85.3	86.8	85.1	83.6	84.7	86.7	*84.9*
	Mean	2.07	1.96	1.84	1.96	2.03	1.94	1.85	1.94	12.8	14.3	15.3	14.1	13.3	14.3	15.6	14.4	82.6	84.7	86.2	84.5	83.4	84.8	86.3	*84.8*
15 Sep	Pamela	2.29	2.18	2.05	2.17	2.23	2.11	2.02	2.12	12.9	14.4	15.3	14.2	13.2	13.7	14.9	13.9	81.7	83.9	85.2	83.6	82.3	83.5	85.1	*83.6*
	Hi poly	1.98	1.85	1.76	1.86	1.94	1.83	1.74	1.83	14.6	16.4	17.3	16.1	14.8	16.2	17.9	16.3	84.9	86.9	88.0	86.7	85.3	86.8	88.4	*86.9*
	Pleno	2.34	2.24	2.09	2.22	2.36	2.29	2.18	2.28	12.6	14.1	14.9	13.8	12.9	13.6	14.4	13.7	80.9	83.2	84.7	82.9	81.3	82.3	83.8	*82.5*
	M.Bianco	2.22	2.13	1.96	2.10	2.27	2.18	2.15	2.20	14.5	16.7	17.6	16.2	14.4	17.1	18.7	16.7	93.7	85.9	87.3	85.6	83.4	86.0	87.1	*85.5*
	Oscarpoly	2.12	2.02	1.86	1.99	2.06	1.96	1.85	1.96	13.6	15.2	15.9	14.9	13.5	14.7	15.7	14.7	83.3	85.3	86.6	85.1	83.6	85.2	86.5	*85.1*
	Gloria	2.07	1.98	1.83	1.96	2.09	2.00	1.88	1.99	14.3	15.6	16.5	15.4	13.8	15.2	16.1	15.0	84.0	85.8	87.1	85.6	83.6	85.4	86.6	*85.2*
	Mean	2.17	20.7	1.93	2.05	2.16	2.06	1.97	2.06	13.7	15.4	16.2	15.1	13.8	15.1	16.3	15.1	83.1	85.2	86.5	84.9	83.3	84.9	86.3	*84.8*
15 Oct	Pamela	2.46	2.34	2.23	2.34	2.35	2.27	2.16	2.26	11.1	12.4	12.3	12.3	11.9	12.4	13.7	12.7	78.4	80.7	82.4	80.5	80.2	81.2	83.2	*81.5*
	Hi poly	2.09	1.99	1.88	1.99	2.04	1.96	1.84	1.95	12.7	14.2	15.4	14.1	13.6	13.9	15.7	14.2	82.5	84.6	86.2	84.4	83.1	84.4	86.5	*84.7*
	Pleno	2.56	2.44	2.33	2.44	2.45	2.37	2.26	2.36	11.0	12.2	13.1	12.1	11.9	12.4	13.2	12.5	77.6	80.0	81.7	79.8	79.7	80.7	82.3	*80.9*
	M.Bianco	2.37	2.25	2.16	2.26	2.36	2.27	2.16	2.27	13.1	14.8	15.8	14.5	13.5	14.9	15.4	14.6	81.5	83.8	85.1	83.5	82.0	83.8	84.8	*83.6*
	Oscarpoly	2.26	2.25	1.99	2.17	2.18	2.11	2.01	2.10	11.7	12.7	14.1	12.8	12.3	13.1	14.3	13.2	80.4	81.6	84.5	82.2	81.5	82.8	84.6	*82.9*
	Gloria	2.23	2.10	1.98	2.11	2.21	2.11	1.98	2.10	12.3	13.3	14.6	13.4	12.5	12.9	14.4	13.3	81.2	83.1	85.0	83.1	81.6	82.6	84.8	*83.0*
	Mean	2.33	2.23	2.09	2.22	2.27	2.18	2.07	2.17	11.9	13.2	14.4	13.2	12.6	13.3	14.5	13.4	80.3	82.3	84.1	82.2	81.4	82.6	84.4	*82.8*
Mean		2.19	2.08	1.95	2.08	2.15	2.06	1.96	2.06	12.8	14.3	15.3	14.1	13.2	14.2	15.4	14.3	81.9	84.1	85.6	83.9	82.7	84.1	85.7	*84.1*
L.S.D. at 0.05 level :																									
Sowing dates (S) :					0.20				0.14				0.22				0.71				0.42				*1.34*
Harvesting dates (H):					0.50				0.07				0.24				0.35				0.40				*0.59*
Varieties (V):					0.30				0.05				0.20				0.29				0.29				*0.34*
SxH :					NS				NS				NS				NS				NS				*NS*
Sxv :					NS				NS				NS				NS				NS				*NS*
HxV :					NS				NS				NS				NS				NS				*NS*
SxHxV :					*NS*				*NS*				*NS*				*NS*				*NS*				*NS*

Data in Table (4) show a significant increase in extraction percentage and extractability with the delay of harvest from 175 to 205 days after planting. Similar results were obtained by Lauer (1997).

Significant difference among cultivars in extraction percentage and extractability were recorded in both seasons (Table 4). The highest values of these traits were obtained from Monte Bianco and Hi poly2 cultivars in both seasons, whereas, the lowest ones resulted from Pleno cultivar in both seasons.

E-Yield (root and sugar ton/fed):

Data in Table (5) reveal significant differences among planting dates regarding root and sugar yields ton/fed. Delayed planting date decreased root and sugar yields in both seasons. The superiority of Sept. planting in root and sugar yields might have resulted from better growth performance in terms of dry matter accumulation as expressed herein, in root length, diameter and weight (Table 1). These results are in line with those found by Lauer (1997), Abd El-Rahim (1998) and Ramadan (1999).

Data in Table (5) show a gradual significant increase in root and sugar yields/fed as harvesting was delayed from 175 to 205 days after planting in both seasons. Harvesting at 205 days after planting produced the highest root and sugar yields in both seasons. The continues increase of root yield with each delay in harvest date may be due to the increments of the period from planting to harvest where more assimilates were accumulated in beet root. These results are in harmony with those obtained by Ramadan (1999) and Abd El-Razek (2003).

Significant differences among cultivars in root and sugar yields were recorded in both seasons (Table 5). The heaviest root yields was obtained from Oscar poly cultivar whereas, the lowest one was resulted from Hi poly2 cultivar in both seasons. However the highest sugar yield was obtained from Monte Bianco cultivar while, the lowest one resulted from Gloria cultivar in both seasons. These variations are to the interaction between genetic background and environmental conditions prevailed during growth period. These results are in line with those obtained by Mokadem (1999), Ramadan nd Hassanin (1999) and Abd El-Razek (2003). Who found that sugar beet cultivars differed in root and sugar yields.

F- Root yield regression analysis:

The response of root yield/fed to delaying harvest of sugar beet 175 days was found out using the orthogonal polynomial tables as described by Snedecor and Cochran(1967). The following response was calculated for the root yield/fed in the two seasons:

$$\hat{Y}^{1st} = 21.9 + 1.98x - 0.19x^2$$

$$\hat{Y}^{2nd} = 21.7 + 1.80x - 0.20x^2$$

Table 5. Root yield and sugar yield as affected by date of planting and number of days to harvest for the six sugar beet cultivars and their interaction in the two seasons.

Sowing Dates	Variety	days to harvest															
		Root yield ton/fed								Sugar yield ton/fed							
		2003/2004				2004/2005				2003/2004				2004/2005			
		175	190	205	Mean	175	190	205	Mean	175	190	205	Mean	175	190	205	Mean
15 Aug	Pamela	23.2	24.8	26.6	24.9	23.6	24.3	25.8	24.6	2.67	3.15	3.66	3.16	2.86	3.12	3.60	*3.19*
	Hi poly	18.2	20.5	21.3	20.0	19.2	20.9	22.1	20.7	2.38	3.01	3.31	2.90	2.62	3.10	3.63	*3.12*
	Pleno	22.4	24.5	25.8	24.2	23.1	23.8	25.9	24.3	2.56	3.10	3.52	3.06	2.82	3.09	3.50	*3.14*
	M.Bianco	22.0	23.8	25.1	23.6	21.2	22.5	23.6	22.4	2.98	3.68	4.05	3.57	2.92	3.40	3.92	*3.41*
	Oscarpoly	24.3	26.1	27.3	25.9	23.8	24.8	26.4	25.0	2.95	3.46	3.86	3.42	2.95	2.33	3.81	*3.36*
	Gloria	20.6	22.5	23.7	22.3	21.1	21.4	23.2	21.6	2.56	3.11	3.44	3.04	2.58	3.86	3.45	*2.96*
	Mean	21.8	23.7	24.9	23.48	21.8	22.9	24.5	23.1	2.68	3.25	3.64	3.19	2.79	3.15	3.65	*3.20*
15 Sep	Pamela	24.3	26.1	27.4	25.9	24.2	25.7	27.1	25.7	3.09	3.69	4.07	3.62	3.14	3.43	3.93	*3.50*
	Hi poly	19.3	21.4	22.8	21.2	19.9	21.6	23.2	21.6	2.73	3.32	3.79	3.28	2.83	3.40	3.98	*3.40*
	Pleno	23.5	25.2	26.4	25.0	23.2	24.7	26.8	24.9	2.87	3.49	3.83	3.40	2.97	3.32	3.79	*3.36*
	M.Bianco	22.7	24.3	25.6	24.2	22.4	23.9	24.7	23.7	3.23	3.91	4.36	3.83	3.19	4.02	4.53	*3.91*
	Oscarpoly	25.5	27.2	28.6	27.1	24.5	26.3	27.7	26.2	3.38	3.68	4.27	3.77	3.22	3.74	4.17	*3.71*
	Gloria	21.3	23.0	24.9	23.1	20.6	22.2	23.9	22.3	2.86	3.48	3.94	3.42	2.76	3.28	3.72	*3.25*
	Mean	22.7	24.5	25.9	24.4	22.5	24.1	25.6	24.0	3.03	3.60	4.04	3.56	3.02	3.53	4.02	*3.52*
15 Oct	Pamela	22.6	24.2	25.8	24.2	22.4	23.8	25.1	23.8	2.52	2.96	3.36	2.95	2.65	2.91	3.35	*2.97*
	Hi poly	17.6	19.2	20.4	19.1	17.2	18.9	20.6	19.9	2.17	2.64	3.03	2.61	2.18	2.52	3.10	*2.60*
	Pleno	21.8	23.6	24.7	23.4	22.1	23.3	24.2	23.2	2.41	2.86	3.20	2.82	2.63	2.88	3.16	*2.89*
	M.Bianco	21.7	23.2	24.8	23.2	20.6	21.8	22.9	21.8	2.83	3.37	3.83	3.34	2.77	3.21	3.46	*3.15*
	Oscarpoly	23.6	25.0	26.7	25.1	22.7	24.6	25.2	24.2	2.72	3.11	3.64	3.16	2.73	3.14	3.48	*3.12*
	Gloria	21.1	21.8	23.0	21.6	19.3	20.0	22.1	20.5	2.42	2.82	3.25	2.83	2.36	2.51	3.08	*2.65*
	Mean	21.2	22.8	24.2	22.8	20.7	22.1	23.4	22.0	2.51	2.96	3.39	2.95	2.55	2.86	3.27	*2.90*
Mean		21.9	23.69	25.1	23.6	21.7	23.0	24.5	23.1	2.74	3.27	3.69	3.23	2.79	3.18	3.65	*3.21*
L.S.D. at 0.05 level :																	
Sowing dates (S) :					0.57				0.51				0.04				*0.17*
Harvesting dates (H):					0.43				0.48				0.11				*0.10*
Varieties (V):					0.41				0.45				0.09				*0.09*
SxH :					NS				NS				NS				*NS*
Sxv :					NS				NS				NS				*NS*
HxV :					NS				NS				NS				*NS*
SxHxV :					*NS*				*NS*				*NS*				*NS*

This result clearly indicates that the root yield/fed was increased by 1.98 and 1.80 ton/fed for each increase of 15 days in the number of days after planting in the two seasons respectively. This increase was diminishing where the quadratic component (c) was significant and hence a higher root yield could have been obtained as predicted from increasing the number of days to harvest was increased to 253.2 and 242.5 days instead of 175 days in the two seasons, respectively. The predicted maximum yields are 27.1 and 25.8 ton/fed, respectively.

Farmers are requested to make their own decisions according to the profit obtained from late or early harvest and as well according to the time available for raising the succeeding crop after sugar beet.

This recommendation is valid for the six sugar beet cultivars as well as the three planting dates under study as their interactions with the days to harvest proved to be insignificant in the two seasons. However, delaying planting beyond 15th of September was favored by a significant decrease in root yield/fed in the two seasons (Table 5).

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استجابة بنجر السكر لميعاد الزراعة وعدد الأيام للحصاد تحت ظروف شمال سيناء

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أجريت تجربتان حقليتان في مزرعة خاصة بمنطقة القنطرة شرق- محافظة الإسماعيلية خلال موسمي ٢٠٠٣/٢٠٠٤ ، ٢٠٠٤/٢٠٠٥ وذلك لدراسة استجابة ستة أصناف من بنجر السكر(باميلا، هاى بولى ٢ ، بلينو، ديل ٩٣٩ ، أوسكار بولى وجلوريا) لثلاث مواعيد زراعة(١٥ أغسطس، ١٥ سبتمبر و ١٥أكتوبر) وكذلك ثلاث مواعيد للحصاد(١٧٠،١٩٠،٢٠٥ يوم من الزراعة) وذلك من حيث المحصول والجودة تحت ظروف شمال سيناء. وأظهرت النتائج المتحصل عليها الآتي :

- أثرت مواعيد الزراعة معنويا على النسبة المئوية للسكروز والنقاوة وأيضا محصول الجذور والسكر في كلا الموسمين، وسجل ميعاد الزراعة فى ١٥ سبتمبر أعلى محصول للجذور والسكر للفدان .
- أظهرت النتائج أن تأخير الحصاد من ١٧٠ الى ٢٠٥ يوم بعد الزراعة أدى الى زيادة فى وزن الجذر ونسبة السكروز والنقاوة والاستخلاص ومحصول الجذور والسكر للفدان،كما أدى إلى انخفاض قيم كل من البوتاسيوم، الصوديوم والالفا- أمينو نيتروجين وأن انسب ميعاد للحصاد هو بعد ٢٠٥ يوم من الزراعة حيث أعطى أعلى القيم لمتوسط وزن الجذر والنسبة المئوية للسكروز والنقاوة وأيضا محصول الجذور والسكر للفدان .
- اختلفت أصناف بنجر السكر تحت الدراسة معنويا فيما بينها فى متوسط وزن الجذر والنسبة المئوية للسكروز ومحصول الجذور والسكر للفدان ، وسجل الصنف أوسكار بولى أعلا محصول من الجذور للفدان بينما سجل الصنف ديل ٩٣٩ أعلى محصول للسكر للفدان .
- ومن النتائج المتحصل عليها من الدراسة فأنة يوصى بزراعة الصنف أوسكار بولى أو الصنف ديل ٩٣٩ في . تصف سبتمبر ويكون الحصاد بعد ٢٠٥ يوم من الزراعة وذلك للحصول على أعلى إنتاج من الجذور والسكر للفدان وأيضا صفات الجودة .
- أوضحت معادلة استجابة محصول الجذور/فدان إمكانية تحقيق محصول أعلى من ذلك المتحصل عليه تحت هذه الدراسة إذا تم تأخير ميعاد الحصاد عن ٢٠٥ يوم من الزراعة وذلك لجميع الأصناف ومواعيد الزراعة تحت الدراسة حيث كان تداخل الفعل بين عوامل الدراسة غير معنوي.