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Investigating of Cultivating the Autumn Sugar Beet in Fars Province (Zarghan)

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Abstract: *As water is the most restrictive factor in national agricultural production, it is necessary to take decreased water consumption and increased water use efficiency in crop production into consideration .Now, spring sugar beet production areas are concentrated in the region with water limitation and hence, the increase in spring production areas concentrates the principal of water and soil conservation. So is necessary that increased the production efficiency in the unit area in this region .Using new region for autumn sugar beet sowing allows the increase in warm and semi- warm beet production areas . The majority growing areas of spring sugar beet meet the limited of water. Increased cultivation of sugar beet in most of these areas is not consistent with the preservation of water resources and soil, so we need to develop new areas of autumn sugar beet there. Using of new zones fall of sugar beet production, creates the possibility that the area under cultivation increased in warm and semi-warm region.*

To develop sugar beet production in province of Fars the study was conducted in agriculture and natural resources research institute zarghan area in strip split plot based on randomized complete Block Design with six replication during 2015-2016. Two sowing dates (October 8 and November 13) in main plot and four cultivars (Azaba, Giada, Spartak and Supryma) in sub main plot were evaluated. Result showed significant effects of sowing dates on white sugar yield in 0.05 level. The results showed that sowing date had a significant effect on the performance of white sugar yield at the level of 0.05. The highest white sugar yield of early planting (17 October) amounts to 14.63 and 15.1 t/ha respectively in Azaba and Supryma was obtained. The highest root yield obtained from early sowing date and varieties of Spartak (54286 kg per hectare) and Gyada (50952 kg/ha), respectively.

The lowest bolt percentage were observed from second sowing date in all four cultivars with zero percentage of bolting. The highest bolting percentage were observed in Spartak cultivar in the first sowing date. The number of bolting plan t in May 21 were detected in each cultivar and were percent of all plants. In harvesting time qualities parameters such as sugar content, molasses sugar content, white sugar content and root yield were determined for determining harmful effect of bolting at production quality. In harvesting time number of root, root weight and shoot weight were measured. According to results and agro climatic condition of zarghan area in fars province it seems that after further study this region will presented as a suitable region for planting autumn sugar beet.

Keyword: *planting date, cultivar, autumn planting, sugar beet.*

1. INTRODUCTION

Sugar is one of the country's energy resources in the basic food basket. Studies show that direct and indirect consumption of sugar provides about 8-10% of the population energy needs. Water is the most important limiting factor for the country's farmers. Therefore, it is necessary to be paid attention to reduced water consumption and increased water use efficiency of crops in this section. Spring sugar beet is growing in regions, which is more severe water restrictions and increase the area under cultivation of this plant in most region spring planting is incompatible with the principle of conservation of soil and water resources so in these regions must be increased the randement of production per unit area. .Using the new zones of sugar beet production, creates the possibility that increased the area under cultivation in warm and semi-warm region. climatic conditions of Iran is in a manner that sugar beet can be cultivated in either spring planting (planted in spring and harvested in the autumn) and autumn planting(planted in autumn and harvested in spring) .

According to data published by the Association of sugar's factories the average of sugar beet cultivation was 154000 ha during 1360-1392.Max share in the total acreage of autumn sugar beet cultivation was 5/7 percent, root yield was 2.6% and sugar production was 3.4% . Autumn cultivation of sugar beet in Iran began since 1342. Many studies on various aspects of farming, breeding, plant protection, economic, quality and other characteristics of autumn sugar beet were done over the past year in Iran.

This results indicate that sugar beet can be identified as an important and influential autumn crops in the periodic system of prone areas. In any case, all studies show that area under cultivation of autumn sugar beet, especially in the areas of Dez and Karkhe River can be developed. In addition to the Khuzestan province which there could be easily increased the area under cultivation of this plant, could be also considered to planting of autumn sugar beet In other areas such as Ilam, Fars, Kerman, Kermanshah.

Even with breeding and the introduction of resistant varieties to bolting and other complementary studies, perhaps in the future also promoted autumn sowing of sugar beet in areas of southern Khorasan, Golestan and Moghan. Considering the unique climatic conditions of Iran, it appears that the introduction of new cultivation zones in sugar beet production is possible And its development will has caused a revolution in agriculture of this strategic product in the country, other hand, the lack of capacity of sugar factories in some of these areas (Moghan, corruption and shirvan sugar factory) can be adjusted to some extent through the development of autumn planting. So, one of the ways to ensure the needs of the sugar factories taking into account the potential areas of the Moghan, Fars and Golestan, is breeding and cultivar development programs and use them to develop resistance to bolting autumn sowing of sugar beet in these areas. Now, autumn sowing of sugar beet in different countries is developing or under study. As far as thinking about autumn cultivation of sugar beet in Northwest Territories of Europe is also suggested. On the other hand bolting undesirable phenomenon (bolting) is limiting factor on autumn sowing of sugar beet is too widely studied and with breeding and presenting of resistant cultivars to bolting to the market, the development of area under cultivation of autumn sugar beet in some countries such as Spain in recent years has successfully completed. In studies conducted in the United States, talk about the autumn cultivation of sugar beet as the right products in sustainable agriculture and the possibility of its development was emphasized in susceptible areas of the country.

In warm climates due to adaptation sugar beet to diverse conditions of climate, planting autumn sugar beet suggested. This match has caused that cultivation of sugar beet extended to lower the orbit of 40 degrees of latitude. In some parts of the Mediterranean region autumn cultivation of sugar beet in southwestern Spain, Portugal, Morocco, Tunisia, Egypt, Iraq and parts of Iran has earned its place.

The main factors limiting sugar beet root yield and sugar yield are vegetative growth during the period including the plant's ability to receive solar radiation that depends LAI. Sugar beet is grown primarily as a spring production (is planted in spring and harvested before the beginning of winter). Rapid and uniform seedling emergence in the early spring is a decisive factor in the leaves development of important factors affecting the final yield. However, due to the low temperatures at this time of year, the leaves expands slowly and favorable shade cover is required to receive radiation only to June 1, so the plants cannot be used 2-40% of the total annual radiation it. In such condition, the use of the spring crops instead of autumn crops is attractive because it creates a situation that can be avoided energy waste. The plants are cultivated as autumn crops (such as oilseed rape and autumn barley) cultivated in autumn and harvested the following year. LAI have developed significantly in autumn crops before entering the winter period, this work makes very simple interception of solar radiation in the spring of next year. As a result, and despite the fact that autumn grain and rapeseed arrive earlier than spring varieties, but autumn types have typically 20 to 30 percent more performance than other spring types. So, autumn planting of sugar beet could be more appealing. It has been shown that seedling of sugar beet is planted in autumn rise rather than spring sugar beet. As expected, the leaf area of autumn sugar beet is also much more. In Iran, the most important factor that can be characterized as an indication of priorities and preference for autumn cultivation of sugar beet is efficient use of Precipitation during the growing season and increase water use efficiency in autumn sugar beet cultivation. This issue becomes more important when the main agricultural limiting factor in Iran seen water. Except for the special case that spring rain help to germinate and establishment of plant, the original growth stages of spring sugar beet is in the summer and plant needs to irrigation in

all their growing period from germination to harvest . However, the main autumn sugar beet growing period is in autumn and winter, and the part of the plant water requirement is supplied by precipitation. Since the distribution of precipitation in different region of country is generally in such a way that about three-quarters of the annual precipitation occurs during autumn and winter, so, autumn cultivation of sugar beet have the possibility that provide a part of their water requirements through the region's precipitation. This will leads ultimately reducing of water consumption and increase the water use efficiency of the production of sugar in autumn sugar beet, In other words, spring and autumn crops of sugar beet produced an equivalent of 853 and 532 grams of sugar consumed per cubic meter of irrigation water. During the growing period is considered one of the main determinants of changes in sugar beet yield.

The growing season Considered one of the main determinants of sugar beet yield changes. Studies on the impact of environmental factors on growth and yield of six sugar beet in 62 different locations have shown that sowing date have the higher affect on the environment's interaction. (Bachett, 1982). Therefore, sowing date can be considered one of the most important factors that determined the yield and quality of sugar beet. (Fellerand Fink, 2004). And of course increase in performance due to early planting with suitable climatic conditions are more tangible (Dillon and Schmehl 1971). The optimum sowing date in any area of sugar beet crop affected any factors such as previous, planting crop, regional climate condition, contracts between farmers and sugar producing company and the planting (Kandil et al, 2004). In the autumn planting of sugar beet, root yield was also increased in early planting n Iran the research about the possibility of autumn cultivation of sugar beet in warm areas (Kermanshah, Kerman, Mashhad and Moghan) determine the most appropriate planting time in the beginning of September and is reported that in most regions delay in cultivation decreased root yield and increased roots impurities. (Basati et al, 2004). With the consideration of country's unique climatic conditions seem that it is possible to introduce new areas of autumn sugar beet production in Iran and Lack of capacity of sugar factories in some of this region can be partially compensate through the development of autumn planting. According to studies done it is possible to developed autumn cultivation in some region of Fars province. With this research; we are going to determine the suitable area or desirable area for sugar beet production due to climatic parameters, for receiving to the best quality and quantity in production and specify the suitable areas for autumn sugar beet cultivation in Fars province.

2. MATERIALS AND METHODS

This research was done at Fars agricultural and natural resources research institute center (Zaghan region in Fars province , 25 km northeast of Shiraz ,located in 52 ° 43 ' E Latitude and 29°47' of longitude and height of 1596 meters from sea level) in 2014-2015. After plowing, disking and leveling, the experimental plots were prepared. After leveling, based on the soil physical and chemical analytical results, Zarghan Soil has texture silty clay loam with values of 6/19 percent field capacity, permanent wilting point at 6.10% and bulk density was 6.1 grams per cubic centimeter.phosphate Ammonium and Urea(1/3 Urea) fertilizers were distributed respectively 200 and 80 kg and disked smoothly before sowing . The plots, based on time calendar, were sown by manual row planting through dry farming and at the same day, the irrigation was done, until emergence, the soil moisture was preserved at the field capacity level and then the irrigation was adjusted on the basis of humidity, precipitation and plant need .In all treatments, at 2-4 leaf stage, the first, and one month later, the second weeding and thinning were carried out manually. After the second weeding and thinning, 1/3 of Urea fertilizer was distributed and irrigation was done the same day. The experiment was carried out as split plot in the randomized complete block design with 6 replication in 2015.In this research, 2 sowing dates of October 8th and November 13of 2014 were assigned to main plot, 4 varieties of Giada,Supryma,Azaba and Spartak (all of this varieties are monogerm and bolting tolerant is different in this 4 varieties) to sub-plots. Each plot included 6 sowing rows of 8 m length and 50 cm spacing and 20 cm spacing in rows. At the harvesting time, after the removing the first and 6th rows of each plot and 0.5 m from both ends of each row, the area of 3 central rows was harvested. Before the cold period the number of established plants per plot was counted and after the cold period, the number of plants was recounted. The harvesting was done at 6 June, the number of bolting plants in each varieties according to the number of all plants was counted in 20 may. At harvesting time the quantity parameters such as sugar content, molasses sugar content, white sugar content, Extraction coefficient, dry weight, sugar content and root yield in treatment was counted and weighed, So that the adverse effects of bolting determined on the quality of the product . Due to the concentration of impurities in

the white sugar or white sugar (grams of sugar per 100 grams of sugar beet) Molasses sugar content in grams of sugar per 100 grams of sugar per 100 grams of sugar and white sugar yield in ton per hectare obtained on the basis of the following relationships.

White sugar yield=sugar contetnt-molasse+0.6

White Sugar recoverable amount of sucrose in sugar beet root) that is calculated by the following formula (percentage points)

Yield= White sugar yield /sugar content*100

Sugar losses of Sugar Factory is considered Equivalent of 0.6 ,amount of molasses is estimated based on the amount of potassium, sodium and nitrogen by one of the common empirical formula (Krunz et al, 2002). Also during the harvest the number of root, root and shoot weight were measured. According to the measurements, sugar yield and white sugar yield was calculated for all experimental plots. Statistical analysis was performed using SAS software. Mean square for traits was performed with Duncan test, analysis of variance and the sliced of data. Weather conditions of Zarghan in Fars Province shows that the minimum, medium and maximum daily temperatures average, was 7.3, 16.8 and 26.3 ° C respectively, and the annual total average of precipitation (term 19 years) in this area is 293.53 mm.

3. RESULT AND DISCUSSION

The changes of sowing dates had a significant influence on the sugar beet root yield at 5% probability level (Table 1), so that with a delay in sowing, (a delay of 36 day) the root yield decreased from 32579 kg/ha to 27321 kg/ha (Table 3) so that delay in sowing decreased the root yield to the 5258 kg/ha. Sowing has influenced the canopy through growth, numbers, size and age of green leaves and, thereby could affect the light intercepted by the plants during the growth period (Rinaldi and Vella 2006). Delay in the seedling emergence could decrease dry matter accumulation in plant, which this difference would remain up to the end of the plant growth period (Stibble and Marlander 2002). Garcia et al. (2004), compared 3 sowing dates (October, November and December), two plant densities (80000 and 100000 per hectare) and 3 varieties, during the autumn sugar beet cultivation in a Mediterranean condition and found that the active growth of sugar beet would begin 160 days after sowing (late winter) and consequently, it would reach to the maximum accumulation of dry matter (20-25 g/m2 per day) and Leaf Area Index (3.9-5). Comparison of 10 sugar beet varieties, in autumn cultivation in the south of Italy showed that the root and sugar yields in the sowing dates of 28th October (65.35 and 10.96 t/ha) were significantly higher than those in the sowing dates of 27th November (57.69 and 9.43 t/ha (Giordano and D' Amato 1976). The influence of varieties on the root yield was not significant and 5 varieties were put in one statistical group (Tables 1, 3).Table 1 show that the interaction between sowing date on root yield in all cultivars was not significant at the level of five percent. In other words postpone the date of sowing reduced root yield and the highest root yield was for the earlier planting date. Although the delayed harvest could enhance the root yield and white sugar content (Lauer 1995), but the importance of additional time for the plant in early-sowing at spring time is more than that in the delayed sowing (Lauer 1997). Anyhow, realizing the highest potentiality of the crop yield necessitates the earliest possible time of sowing and delayed harvesting (Cakmakci and Oral 2002).

Table1, 2. *Mean of squares of the combined analysis of some quality and quantity characteristics of sugar beet for sowing date and variety, Zarghan, Fars, 2015*

Sugar extraction coefficient	Sugar molasse	White Sugar yield	Sugar Content	Root Yield	Degree of Freedom	Source of variation
20.507402	0.29989833	3.8292121	4.04547708	192386196.5*	5	Rep
123.424602	1.04430000	19.0134188*	11.14576875*	331748252.1	1	Sowing date(B)
10.514291	0.09822167	1.2667332	1.04106931	56252951.3	15	(Ea) Error
593.438508**	4.75945833**	43.1855799**	19.32622431**	176921809.1	3	(A)Variety
10.284669	0.08158333	1.5508576	1.00784097	112640420.1	3	A*B
7.353427	12.26711	13.11928	6.963413	22.39289		CV

(1)

Bolting %	Number of bolting	Degree of Freedom	Source of variation
133.57083	20.600000	5	Rep
8242.52083**	7056.750000**	1	Sowing date(B)
74.08194	44.433333	15	(Ea)Error
4196.96528**	2975.916667**	3	(A) Variety
4196.96528**	2975.916667**	3	A*B
71.97369	51.15729		cv

(2)

*, ** and ns are significant at levels of 5%, 1% and insignificant, respectively. As F test was insignificant for the experimental errors, the pooled error was used.

4. SUGAR CONTENT

The sowing date had significant influence on sugar content (Table 1). The review of literature in this regard also represented that in spite of the negative influence of delayed sowing on the elongation of seedling emergence period and consequently on root yield decrease, this matter had no influence on the quality components of sugar beet (Stibbe and Marlander 2002). postponing the sugar beet sowing date, from October to November, caused the reduction of the root yield from 67.2 to 48.4 t/ha, and enhancement of sugar content, from 10.9% to 13%. The studied varieties, at 1% probability level, had significant influence on sugar content (Table 1) and the variety Supryma produced the maximum sugar content (17.63) at the first sowing date (Table3)

Table3. *Grouping of mean of some sugar beet quality and quantity characteristics in the experiments of sowing date and variety, Zarghan, Fars, 2015*

Sugar Molasses	White Sugar yield	Sugar Content	Root yield	Source of Variation
4.3454 a	11.5904 a	16.5358 a	32579 a	First Sowing date(8.oct)
4.6404 a	10.3317 b	15.5721 b	27321 b	Second sowing date(13.nov)
4.1108 b	11.9525 a	16.6633 a	35119 a	Azaba
4.3458 b	11.5083 a	16.4542 a	26468 b	Spartak
5.4217 a	8.1508 b	14.1725 b	30516 ab	Gyada
4.0933 b	12.2325 a	16.9258 a	27698 b	Supryma

*Means with the same letter in each column have no significant differences at 5% level.

5. WHITE SUGAR YIELD

The sowing date influenced white sugar yield significantly, at 5% probability level (Table 1). The highest white sugar yield was related to the sowing date of 8th October, and the delayed sowing of 37 days, with the decrease of 12.18%, reduced white sugar yield from 11.59 kg/ha in the first sowing date to 5.68 and 10.33 kg/ha in the second sowing date (Table 3). Among the cultivated varieties, the Suprymas was had the highest white sugar yield per hectare(with 12.23 kg/ha), and the average interaction of planting date * varieties in white sugar yield still in first planting date and the highest white sugar yield was estimated varieties Supryma at a rate of 12.775.

Various reason have been mentioned for the increase of the crop yield in early sowing, including the linear relation between sugar yield and light interaction quantity (Storer et al. 1973 . Biscoe et al .1979; Fortune et al. 1999). In this study per day of delay in sowing decreased 0.03kg/ha of white sugar yield. The interaction of varieties on WSY was significant(at 5% probability) but the interaction of sowing date * varieties on WSY was not significant (Table 1).It is expected that the varieties which have high sugar yield at early sowing , would keep their superiority in the delayed harvest too(Rimon et al,1977). In these experimental conditions, with delayed sowing , standard deviation and variance of withe sugar yield among were various varieties were decreased, and showed that, with elongation of growth period (early sowing), the differences among varieties were increased . Therefore , it is recommended that the early maturing genotypes would be used for early sowing and late – maturing genotypes would be applied for delayed sowing or early harvesting(Lauer 1997).In these experimental condition , with delayed sowing , standard deviation (respectively in Azaba, Spartak, Giada and Supryma varieties was decreased in comparison of second sowing date and first sowing date equivalent 0.72,1.024, 1.23 ,0.75 kg/ha) and variance of white sugar yield among various varieties were decreased , and show that with elongation of growth period (early sowing), the differences among varieties were increased . So, it is recommended that the early maturing genotypes

would be used for early sowing and late maturing genotypes would be applied for delayed sowing or early harvesting (Lauer, 1977). In this study , although the interaction of sowing date* variety was not significant (Table 1) , considering the different yield of varieties ,in different sowing dates Azaba was known as early maturing varieties, Giada as late-maturing variety , Supryma and Spartak was known as middle maturing verities.(Figure2).

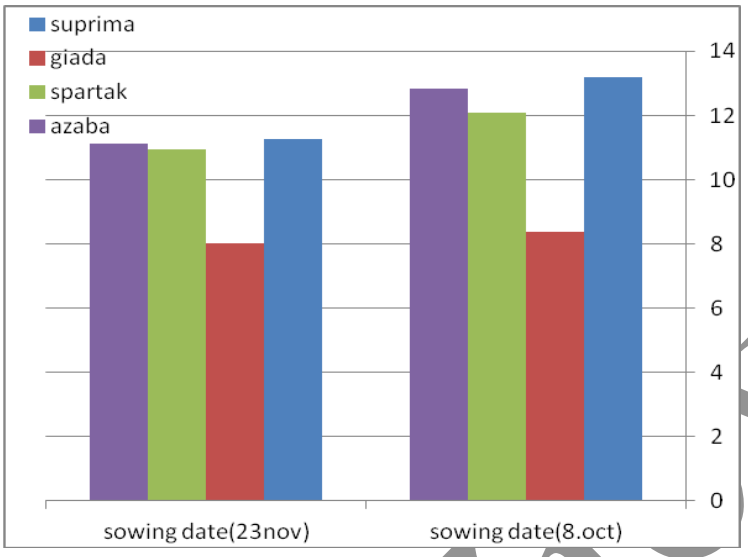

Figure2. *Ranking of white sugar yield in varieties under different sowing date*

6. MOLASSES SUGAR

Sugar component and non-sugar component in root sap are reach out as molasses so whatever sugar is low in molasses the root quality is high and efficient coefficient increased.(Koochaki and soltani,1996). The result of analysis variances show that molasses sugar not affected by sowing dates and .In this study early sowing date (8.Oct) have 4.6404 % of molasses sugar that is 1% higher than late sowing date (23.Nov) (4.3454 %). According to the depending of molasses sugar on the amount of root impurities and given that the sodium and potassium concentrations were higher in later sowing dates, increasing of Sugar molasses in later sowing date than earlier sowing date was expected. (Figure3) between different levels of varieties a significant influence on the molasses sugar at 5% of probability level was observed. Gyada with an average 5.4217 was higher than other varieties (With an average of 29% more) and the Supryma with an average value of 4.0933 molasses sugar has the lowest molasses sugar between other varieties (Table 3).According to the amount of sodium and impurities nitrogen in Gyada variety that was in the highest group, so molasses sugar in this variety had also the highest rate. In Supryma and zaba varieties as well as the amount of sodium and impurities nitrogen was the lowest so the rate of molasses sugar was less than the other varieties. The difference values obtained of sodium and impurities nitrogen was low and were analyzed in one statistical group. Taleghani (1392) and Rinaldi and Vanala (Rinaldi and Vonella, 2006) also reported that the using varieties in autumn cultivation of sugar beet, there was a significant difference. (Table 3).

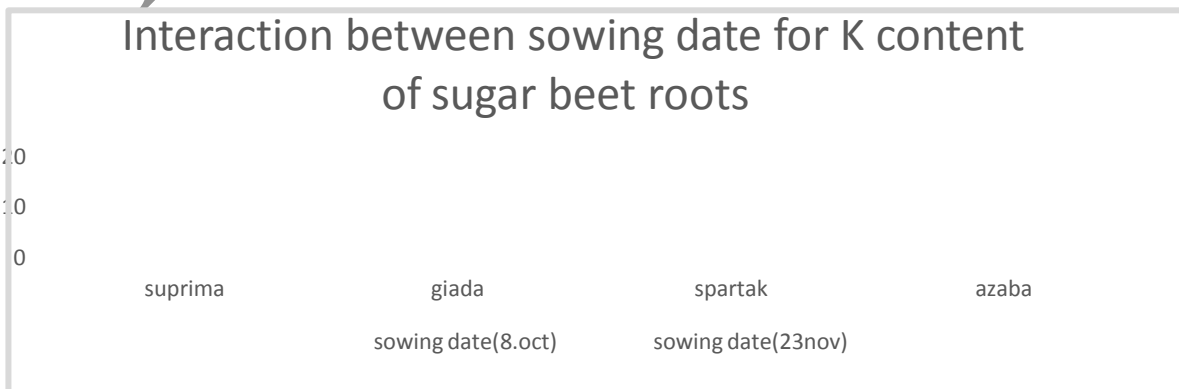

Figure3. *Interaction between sowing date for K content of sugar beet roots*

7. BOLT PERCENT AND THE NUMBER OF BOLTING PLANTS

Changes in sowing dates at 5% probability level had significant influence on number of bolting plants and bolt percent and Bolt percent decreased with applying late sowing date.

The amount of the reduction was 26 % of bolting in early sowing date and 0% in late sowing date in planting of autumn sugar beet percent. In the studied varieties the Supryma with 1.83 percent of Bolting and the Spartak with 41 percent of bolting had lowest and the highest percentage of bolting respectively.

According to the obtained results the number of bolting plants in the varieties of Spartak and Supryma was estimated 35.4 and 1.9 in that was the highest and lowest value of this parameter, respectively. So the variety of Supryma and Spartak were identified as resistant and sensitive variety to bolting respectively. 84 foreign varieties of sugar beet seeds registered in Iran until now, 26 varieties are resistant to bolting and these varieties are suitable for autumn planting. Most of these varieties are only suitable for autumn sowing in the Khuzestan region and cannot be used in other areas. The results indicated that the differences in resistance to bolting in different varieties is resulting from differences in the young stage, the need for cold, the maximum temperature for vernalization and the minimum temperature for Devernalization, sensitivity to long days and the sensitivity to Devernalization. (Sadeghzade et al, 2015)

Since the autumn sowing of sugar beet in many areas confront the risk of bolting and flowering, and this phenomenon influenced by genetic, environmental and physiological factors; the development of autumn sowing in some areas where their winters are long (Gorgan and Ilam), requires planting the resistant varieties to bolting.

It can be through to setting two sowing dates and the selection of resistant varieties and producing the seed in temperate regions, can be prevent the bolting in plant somewhat. By using gibberellin acid in many studies have been to study the stem elongation. Application of gibberellic acid, accelerating the bolting and flowering in vernalized sugar beet. Gibberellic acid can also be induced bolting in the absence of Vernalization and independently of the photoperiod, but it cannot be increased flowering , as result, and contrary to other species that can compensate the lack of vernalization or compensation of photoperiod signaling, this hormone in sugar beet cannot have complete control alone on the flowering process. (Margara, 1960). (Mutasa-Gottgens, and Hedden. 2009).On the other hand, it has been shown that exposure sugar beet exposed to very long days (with 22 hours of light) is seek to bolting, accelerate flowering and increased vernalization. (Muller and Hedden. 2010).

In recent years, taking advantage of resistant varieties to bolting is moving towards more early planting dates. It should be noted that in the autumn sowing, late sowing seeds in areas with long winters Can be especially decreased the possibility of bolting at the same time with increasing the day in the spring. But must has chosen wisely management between the amount of yield reduction, resulting from delay in planting and yield and product quality reduction resulting from bolting.Some reports also suggest that bolting increase is the result of using nitrogen and the plant density. It seems that all the factors that increase the growth increases also the bolting.

8. CONCLUSION

Considering the Agro climatic region of Fars province and Zarghan region, it seems that the region is suitable for sugar beet autumn cultivation. On the other hand, since the average minimum monthly temperature of Zarghan is high, the importance of choosing the appropriate bolt-resistant variety in this region is less so that in the present study, bolting percent of 4 tested varieties was low. The evaluation of temperature conditions of Zarghan showed that the 19-year average of minimum annual temperature was 6.06 °C. The minimum and maximum of minimum annual temperature were 7.3 (year 1999) and 8.9°C (year 2012), respectively, and the minimum average of minimum monthly temperature (-2.1°C) was in January and the maximum average of the minimum monthly temperature (29.5°C) was in July (Figure 1(a)). The average maximum annual temperature of this region was 27.77°C (Figure 1(a)) and the average annual temperature was 2.12° C (Fig 1(a)). One year of 19 years of studies (5%) lacked the days of the minimum daily temperature or below 0° C. During the same period, the mini-mum daily temperature (-4.3°C) occurred in January of year 2007 and 2009, and the maximum daily temperature (39.5°C) was in June of year 2013. Zarghan region is a cool region and based on statistics, the average, minimum average and maximum of annual temperature in

Zarghan region was 7.3, 16.8 and 26.3°C. On the other hand, in about 18 of 19 studied statistical years (1997-2015), the temperature was decreased down to below 0°C. The results of this study represented the significant influence of sowing dates on white sugar yield. Although the decrease of growth period to 1 months (due to the delayed sowing) caused decrease in white sugar yield to 12.18%. The maximum white sugar yield (12.23 kg/ha) was the outcome of early sowing (8th October) in variety Supryma .So considering to obtained result of this study variety Supryma and Gyada were known as the most resistant varieties to bolt and suitable for autumn sowing in the region , as well as the second sowing date (13 November) with estimating of 11.59 kg per hectare yield of white sugar were identified as the optimum sowing date for autumn sugar beet cultivation in Zarghan region of Fars province.

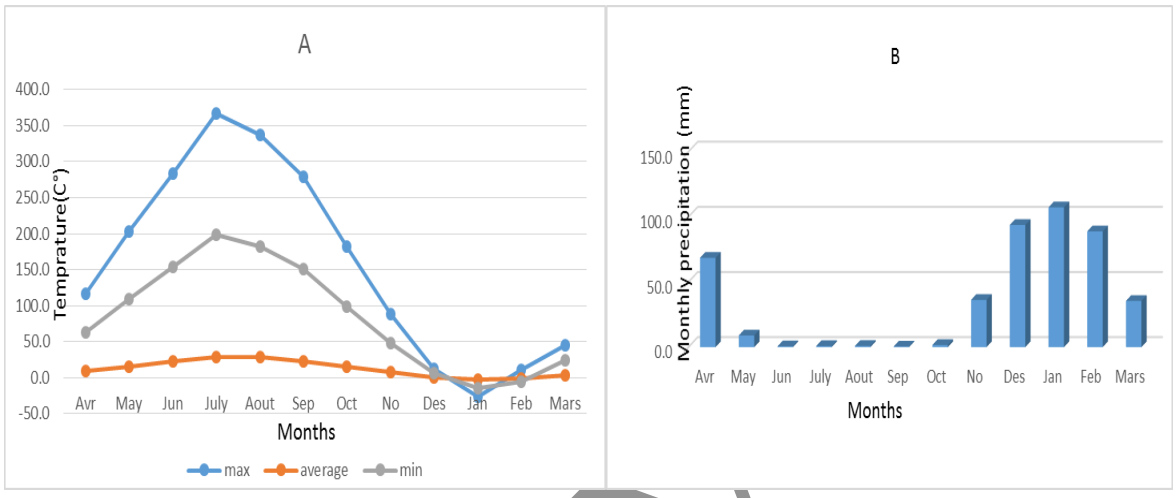

Figure (1A, 1B): *Variations of long-term months average of (A) minimum, mean and maximum temperature and (B) mean monthly precipitation in Zarghan,Fars*

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