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Effect of different sowing dates on the essential oil yield of bitter gourd (*Momordica charantia* L.)

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ABSTRACT

This study was done to investigate the effect of sowing date on the essential oil yield of the bitter gourd (Momordica charantia L.). A randomized complete block experiment with three replications was carried out at Konarak in Iran, during May 2011 to January 2012. There were three levels of sowing date viz. May22, September 23 and January 21. In this test characteristics of the number of branch, number of flower per plan, fruit dry weight per plant, grain yield, essential oil percentage and essential oil yield were evaluated. Analysis of variance showed that the effects of different sowing dates, were significant on all traits with the exception of the number of branch trait. In general, the results of this experiment showed that number of flower per plant, fruit dry weight per plant, grain yield, essential oil yield, increased in earlier sowing date, but essential oil percentage increased in the late sowing date. Therefore, in accordance with the production of higher essential oil yield, sowing date of May 22 is recommended for the bitter gourd cultivation in the Konarak city.

Keywords: Essential oil yield, bitter gourd (*Momordica charantia* L.), Grain yield, Flower, Sowing date.

INTRODUCTION

Momordica charantia L. is a herbaceous climbing plant in the genus momordica of family Cucurbitaceae, which is widely distributed in tropical, subtropical and temperate regions [1]. The yellow flowered plant is widely distributed in tropical regions of South East and Far East Asia to Australia and South Africa [2]. *Momordica charantia* L. is bitter in taste and cold in nature, which is used in the treatment of fever with thirst, heat stroke, dysentery, dye redness and pain, carbuncles, erysipelas, malignant sores, etc.[1]. It also possesses anti-HIV, anti-helminthic, anti-tumor and wound healing properties [3,4]. Fresh juice of bitter melon acts as an inhibitor of lipogenesis [5]. In recent years, research on *Momordica charantia* L. has been concentrated on fruits and seeds, and a variety of chemical constituents have been isolated and purified from fruits and seeds of *Momordica charantia*L. [6,7]. The young fruit is emerald green, turning to orange-yellow when ripe. At maturity, the fruit splits into three irregular valves that curl backwards and release numerous reddish-brown seeds [8]. It is mainly cultivated as a spring-summer crop. Growth and flowering of the crop coincide with high temperature (30-40 C) during April-May; and the result is predominance of male flower and higher flower drop [9]. Seed yield of the bitter gourd is influenced by many factors like sowing date, plant spacing, number of fruits per plant, etc. Seed quality has been described as a multiple concepts comprising several components [10]. For seed production, farmers usually grow this crop in summer

season when the prevailing climate is not congenial for seed production of most of the summer vegetables, including bitter gourd. As a result, seeds of bitter gourd do not meet the proper seed quality parameters, and farmers do not get healthy plants from these seeds [10]. Summer season is preferred over the rainy season for raising seed crops because they have thick seed coat, seeds do not dry properly in humid weather [11]. Sowing times has remarkable effects on growth and yield of most crops in different parts of the world as delay in sowing beyond the optimum time usually results in yield reduction [12]. The effect of sowing date on growth, yield and active ingredients of medicinal and aromatic plants was studied by many investigators. Ahmad et al. [13] studied the effect of different sowing dates (June 14, 21, 28, July 5, 12, 19, 26 and August 2) on yield contributing traits of Mash bean (*Vigna mungo* L.) and their results showed that number of fruit-bearing branches, 1000-grain weight, pods per plant, seeds per plant and grain yield were significantly affected by sowing dates and higher seed yield was recorded when the crop was sown on June 28. Also Zayed et al. [14] reported that various growth parameters and yield of borage were affected by the sowing date and were decreased as the sowing date was delayed. Marotti et al.[15] expressed that essential oil yields of fennel (*Foeniculum vulgare*) affected by genotype, growth and development stages and in addition agronomy practice such as different water regimes, nutrients and other environmental conditions such as sowing dates. As well Haj Seyed Hadi et al. [16] in one study in order to investigate the effects of planting time on flower yield and active substance of chamomile (*Matricaria chamomilla* L.). Treatments in their study were three planting times (5, 15 and 25th March). They reported that the highest number of flower per plant, fresh flower per plant, dried flower per plant, fresh flower yield, dried flower yield, essential oil yield, chamazulene percentage and chamazulene yield were obtained from the first planting time (5th March). As well Lafond et al. [17], stated that oil yield of flax, showed a significant response (P: 0.0001) to planting date, decreasing from 844.75 kg.ha^{-1} to 644.35 kg.ha^{-1} in the late date. Latifi et al. [18] studied sowing date (April 18, 29 and May 9) effects on seed yield of *Cucurbita pepo*, they reported that the highest seed yield of *Cucurbita pepo*, was recorded in plots sown on April 18 in comparison with the other studied sowing dates (April 29 and May 9). In accordance with this note, bitter gourd is an important medicinal plant and there is a few agronomic study about this plant. Therefore, the objective of the current research was to investigate the effect of different sowing dates on the essential oil yield of the bitter gourd (*Momordica charantia* L.).

pMATERIALS AND METHODS

This study was carried out in the experimental farm, at Konarak city, Iran during 2011-2012. The field experiment was carried out in randomized complete block design with three replications. There were three levels of sowing date viz. May 22, September 23 and January 21. Properties of soil samples are reported in Table 1.

Table 1: Physicochemical properties of soil

Soil depth (cm)	Texture	EC (mmoh/cm)	Acidity	Organic carbon (%)	Absorbance phosphorus (ppm)	Total nitrogen (%)
0-60	Loam	3	7.4	0.54	8.5	0.06

Field was prepared with the length of 43 m and with the width of 95 meters and the distance of blocks were 1 m. Irrigation of plants was carried out based on weather conditions, soil and requirement of plant also other post sowing cultural practices: weeding, irrigation, fertilizer, hoeing was done regularly during the growing season. At the time of 50% flowering and end of vegetative growth, 10 plants from each plot were randomly selected and harvested and number of branch and number of flower per plant of selected plants, were recorded. In order to evaluate seed yield traits, 10 plants from each plot were randomly selected were collected at the time of maturity for each treatment. After harvesting, selected fruits, were dried in the shade and then the number of fruit dry weight were measured using a carriage scale and grains of them were out and grain yield for each treatment was measured using a carriage scale and using standard moisture at 14%. Essential oil of grain was extracted by hydrodistillation of ground bitter gourd using a Clevenger apparatus. Finally, evaluation for the essential oil yield trait was determined by the following formula;

Essential oil yield= Essential oil percentage × Grain yield

After normalization test, data were subjected to analysis of variance (ANOVA) using Statistical Analysis System (SAS Institute) and followed by Duncan's multiple range tests. Terms were considered significant at $p \leq 0.05$.

RESULTS

Number of branch

Results of analysis of variance (Table 2), demonstrated that the simple effect of sowing date treatment was not significant on the number of branch,.

Table 2: Analysis of variance results of the bitter gourd (*Momordica charantia* L.) traits under different sowing dates

		Mean squares					
Sources of variation	**df**	**Number of branch**	**Number of flower per plant**	**Fruit dry weight per plant**	**Grain yield**	**Essential oil percentage**	**Essential oil yield**
Replication	2	3.11**	o.111^{ns}	61.77^{ns}	7228.00*	0.009**	1827.77**
Sowing date	2	0.11^{ns}	13.77**	4427.10**	7639.00**	0.001*	300.63**
Error	4	0.11	0.611	64.98	413.00	0.0001	24.65

**and **: Significant at 5 and 1% levels respectively*

Number of flower per plant

According to the results of analysis of variance (Table 2), the simple effect of sowing date treatment on the number of flower per plant, was significant ($p \leq 0.01$). The results for the means comparison of Duncan (Fig. 1), demonstrated that the highest number of flower per plant (7 flowers per plant) was obtained from the sowing date of May 22 and while the minimum amount of this trait was achieved by the treatment of January 21 (3 flowers per plant) which was statistically similar to the treatment of September 23 (3.66 flowers per plant) sowing date.

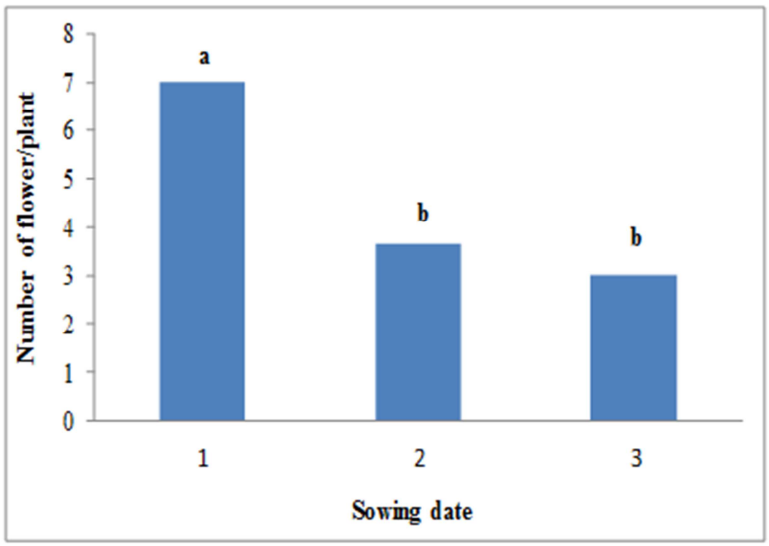

Fig 1: Effect of sowing date on number of flower per plant of bitter gourd
Note: Sowing date: 1- May 22, 2- September 23, 3-January 21

Fruit dry weight per plant

According to the results of analysis of variance (Table 2), the effect of sowing date treatment on fruit dry weight per plant of bitter gourd plant, was significant at $p \leq 0.01$.The results for the means comparison of Duncan, (Fig. 2), demonstrated that the highest dry weight of fruit per plant (135.82 g per plant) was related to the sowing date of May 22 while the least amount of this trait (75.10 and 70.64 g per plant) was achieved by sowing date of September 23 and January 21 respectively. So that there were no statistically significant difference between these sowing dates.

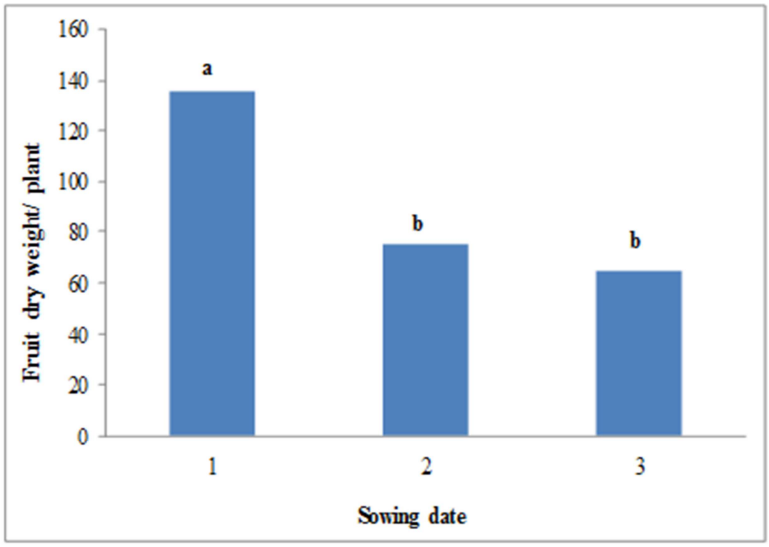

Fig 2: Effect of sowing date on fruit dry weight of bitter gourd
Note: Sowing date: 1- May 22, 2- September 23, 3- January 21

Grain yield

According to the results of analysis of variance (Table 2), the main effect of sowing date on the grain yield trait, was significant at the level of $p \leq 0.01$. The results of means comparison (Fig 3) showed that, sowing date of May 22, had the highest grain yield (240 $kg.ha^{-1}$), while the treatment of September 23 (163 $kg.ha^{-1}$grain yield) and January 21 (145 $kg.ha^{-1}$) had the least amount of this trait and these sowing dates in terms of the amount of this attribute were placed in the same statistically group.

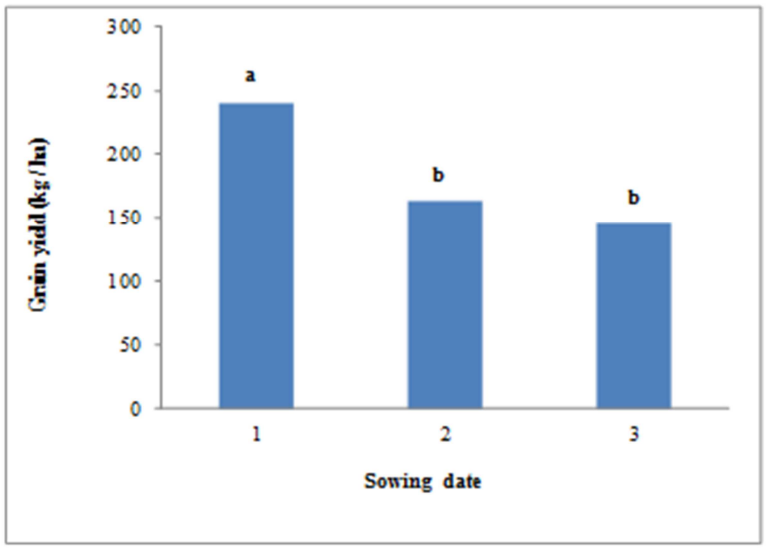

Fig 3: Effect of sowing date on grain yield of bitter gourd
Note: Sowing date: 1- May 22, 2- September 23, 3- January 21

Essential oil percentage

The results of analysis of variance (Table 2), indicated that the effect of sowing date treatment on essential oil percentage, was significant ($P \leq 0.05$). On the basis of means comparison results (Fig. 4) treatments of September 23 and January 21 respectively with the amounts of 0.292 and 0.312 percentage, had the highest essential oil percentage and were placed in the superior group, but the least amount of essential oil percentage (0.264 percentage) was related to the sowing date of May 22.

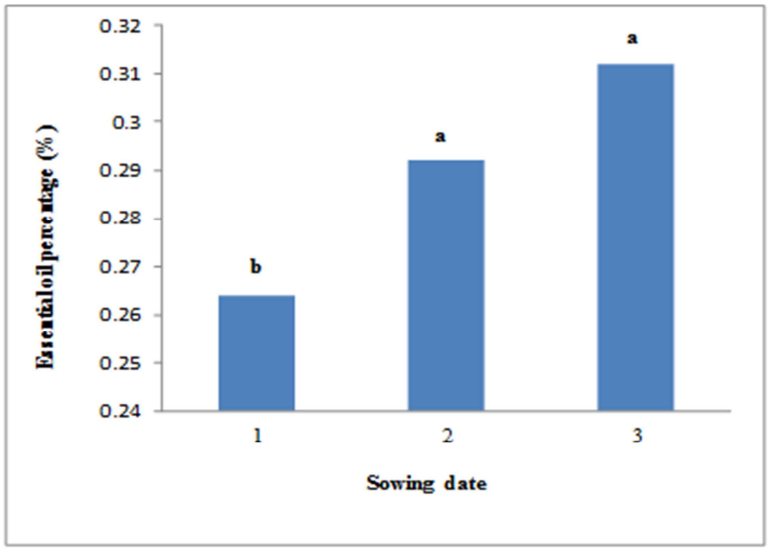

Fig 4: Effect of sowing date on essential oil percentage of bitter gourd
Note: Sowing date: 1- May 22 ,2- September 23, 3- January 21

Essential oil yield

According to the results of analysis of variance (Table 2), the effect of different sowing date treatments on the essential oil yield, was significant ($p \leq 0.05$). The results for the means comparison of Duncan (Fig. 5), demonstrated that the highest level of essential oil yield (65.41 kg.ha^{-1}) was obtained by the bitter gourd plants that their sowing date was on May 22, while the minimum amount of this trait was achieved by the plants that were planted on September 23 (48.94 kg.ha^{-1}) and January 21 (47.32 kg.ha^{-1}) so that there were no significant difference between these treatments.

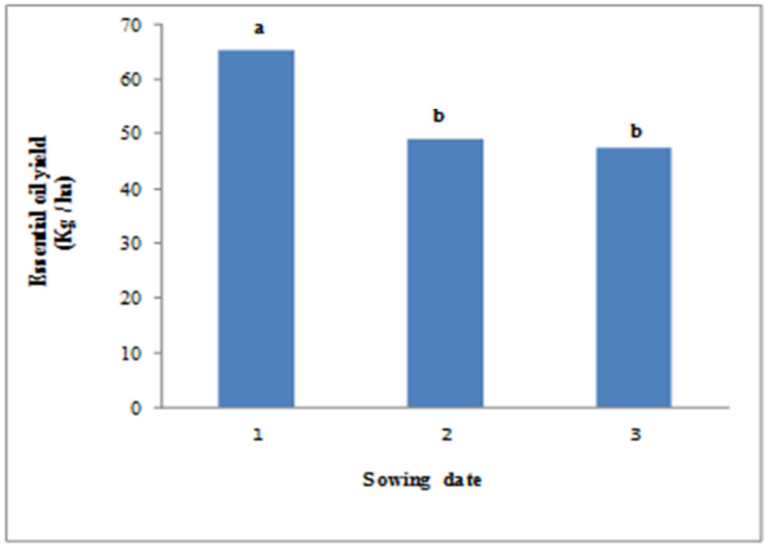

Fig 5: Effect of sowing date on essential oil yield of bitter gourd
Note: Sowing date: 1- May 22 ,2- September 23, 3- January 21

DISCUSSION

The results of this experiment showed that delaying in sowing date of the bitter gourd decreased quantity and quality characteristics such as number of flower per plant, fruit dry weight per plant, grain yield, essential oil percentage and essential oil yield. It should be emphasized that selection of bitter gourd planting date is one of the most important

management decisions for essential oil production. In this experiment, as was observed, the number of flower for this medicinal plant was affected by sowing date significantly. This is probably due to extended periods of plant growth, higher plant height and creating of branch [19]. The results of Ahmad et al. [13], showed that the largest number of branches per plant was obtained from the plants which were sown in the earlier date. The grain yield per hectare and fruit dry weight obtained in this study were significantly affected by planting date. The reasons for this behavior is the increased growing season with early planting allows the plant to the desired use of water, nutrients and light raised photosynthesis process rate and increased its weight. Similar the result of this experiment, Zayed et al. [14] reported that various growth parameters and yield of borage were affected and were decreased as the sowing date was delayed. Consistent with these results, the results of Latifi et al. [18], showed that the highest seed yield of *Cucurbita pepo*, was recorded in plots shown on April 18 in comparison with the other studied sowing dates (April 29 and May 9). The yield of essential oil in this plant was significantly affected by the sowing date. The first sowing date gave the maximum yield of essential oil. So that, bitter gourd planted on May 22 date has essential oil yield potential than late-planted bitter gourd. Marotti et al.[15] expressed that essential oil yields affected by genotype, growth and development stages and also agronomy practice such as different water regimes, nutrients and other environmental conditions such as sowing dates [19]. Increasing of essential oil percentage in date of January 21 was probably due to the appropriateness of the lower temperature for the synthesis of essential oil. However, considering that oil yield was obtained by the multiplying of grain yield and essential oil percentage. Planting date of May 22 had the maximum essential oil yield because of higher grain yield. In agreement with our results, Haj Seyed Hadi et al. [16] investigated the effects of planting times (5, 15 and 25th March) on flower yield and active substance of chamomile (*Matricariachamomilla* L.). They reported that the highest number of flower per plant, fresh flower per plant, dried flower per plant, fresh flower yield, dried flower yield, essential oil yield, chamazulene percentage and chamazulene yield were obtained from the first planting time (5th March), because in this sowing date, hotosynthesis increased by development of leaf area and therefore, increased essential oil yield. As well Lafond et al. [17], reported that oil yield showed a significant response (P: 0.0001) to planting date, decreasing from 844.75 kg.·ha^{-1} to 644.35 kg.ha^{-1} in the late date.

CONCUSION

It was evident from the results of this experiment that significant increasing in the growth parameter and yield per plant were obtained with the earliest sowing (May 22). The highest grain yield (240 kg.ha^{-1}) and essential oil yield (65.41 kg.ha^{-1}) were obtained from the earliest sowing (May 22) while the later sowing (September 23 and January 21) produced the minimum grain yield (163 and 145 kg.ha^{-1} respectively) and essential oil yield (48.94 kg.ha^{-1} and 47.32 kg.ha^{-1} respectively) in the same trend.

REFRENCES

[1] W. Li, Zh. Lin, Ch. Yang, Y. Wang, Y. Qiao,*J Biomed Res*,**2015**, 26, 415-419.
[2] S. Nazimuddin, S. Shaharyar,H. Naqvi, Flora of Pakistan. Department of Botany, University of Karachi, **1980**.
[3] R. Huang, F. Fang, F. Zhuang, H. Kang, Y. Huang, H. Lou. *ActaHort*,**2010**, 871, 395-402.
[4] V. Prasad, V. Jain, D. Girish, A.K. Dorle,*J Herb Pharm*,**2006**, 6, 105-115.
[5] P Nerurkar, R.B. Ray,*Pharmacol Res*,**2010**, 27, 1049–1053.
[6] L. Ma, A.H.Yu, L.L. Sun, W. Gao, M.M. Zhang, Y.L. Su, H. Liu, T.F. Ji, D.Z. Li. *J Asian Nat Prod Res*,**2014**, 16, 476–482.
[7] Q.Y. Li, HB. Chen, Z.M. Liu, B. Wang, Y.Y. Zhao, *Magn. Reson.Chem*,**2007**, 45: 451–456.
[8] I. Ahmed, E. Adeghate, A.K. Sharma, D.J. Pallot, *Diabetes Res ClinPr*, **1998**,40, 145–51.
[9] M.K. Pandit, P.K. Pal, B.K. Das,*J Plant ProtSci*,**2010**, 2, 86–91.
[10] YN De Geus, AS Goggi, L Pollak,*AgrSust Dev*,**2008**, 28, 541–550.
[11] V.S.Seshadri. Cucurbits. In: T.K. Bose, M.G. Som, Ed. Vegetable crops in India, edited by NayaProkash, Calcutta, India. **1986**.
[12] T. Vange, I.U. Obi IU. *J Sustain Dev Agric Environ*,**2006**, 2, 1–9.
[13] H.B, Ahmad, M.A. Amin, I. Hussian, Ch.M. Rafique, M. Naveed, M.A. Awais, S.M hafiq, M. Aqeel. *Int. J. Agr. Agri. Res*,**2014**,5, 42–48.
[14] A.A. Zayed, A.A. Sadek. A.M. Kandeel. *Egypt J Basic ApplSci*,**2003**, 18, 263–85.
[15] M. Marotti, V. Dellacecca, R. Piccaglia, E. Glovanelli. *ActaHort*,**1993**, 331, 63–69.
[16] M. Haj SeyedHadi, Gh. Noormohammadi, J.M. Sinaki, N. Khodabandeh, N. Yasa, M.T. Darzi. 4th International Crop Science Congress, **2004**.

[17] G.P. Lafond, B. Irvine, A.M. Johnston, W.E. May, D.W. McAndrew, S.J. Shirtliffe, et al.*Can J Plant* Sci,**2008**,88, 485–500.
[18] M. Latifi, A-R.Barimavandi, Sh. Sedaghathoor, S-D.Rezaei, A. Lipayi. *In J AgricBiol*,**2012**, 14, 641–644.
[19] R. AghaeeOkhchlar, R. Amirnia, M. Tajbakhsh, M. Ghiyasi, M.B. Alizadeh. *Int. Res. J. Appl. Basic. Sci*,**2012**, 3,353–361.