VOL. 11, NO. 12, DECEMBER2016 ISSN 1990-6145
ARPN Journal of Agricultural and Biological Science

www.arpnjournals.com

EFFECTS OF SOWING DATE ON THE MORPHOLOGICAL TRAITS AND FRUIT YIELD OF BITTER GROUND

Shirzad Kamali[1, 3], Payam Moaveni[1], Sayed Alireza Valadabadi[1, 2] and Ahmad Mehraban[3]
[1]Department of Agronomy and Plant Breeding, Shahr-e-Qods Branch, Islamic Azad University, Tehran, Iran
[2]Department of Agronomy and Plant Breeding, Takestan Branch, Islamic Azad University, Takestan, Iran
[3]Department of Agronomy and Plant Breeding, Zahedan Branch, Islamic Azad University, Zahedan, Iran
E-Mail: shirzadkamali2016@gmail.com

ABSTRACT

In order to study the effects of sowing date on the morphological traits and fruit 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. The results showed that traits of the number of fruit per plant, length and diameter of fruit, plant height, number of leaf per plant and yield of dried fruit were affected by the treatment of sowing date. The results of the experiment demonstrated that the majority of morphological parameters and fruit yield were significantly increased at the earlier sowing date (May 22). Considering the fruit yield, the treatmentof May22 sowing date appeared to be recommendable for thecultivation of the bitter gourd at konarak in Iran.

Keywords: bitter gourd (*Momordica charantia* L.), sowing date, morphological traits, fruit yield.

INTRODUCTIONS

Plant of *Momordica charantia*Linn., known as the bitter gourd, belongs to family Cucurbitaceae. It is cultivated throughout India, Malaya, China, Tropical Africa and America (Upadhyay *et al*., 2015).The plant is called by different names since it grows in tropical regions such as India, Malaya, China, tropical Africa, Middle East, America (Kirtikar *et al*., 1993).The bitter taste, for which the fruit is named, is perhaps due to the alkaloid momordicine, sometimes generalized as cucurbitacine (Wills *et al.,* 1984).The fruits, leaves, and roots of bitter melon are traditionally believed to have medicinal value in reducing blood sugar levels for diabetic patients (Islam *et al*., 2011). Mature fruits attain the size of medium-sized cucumbers and are then harvested like squash, and are cooked as green. For medicinal purposes, the fruits may be used fresh as pulp or juice or dry in powders, or in fluid extracts (Bown, 1995).The typical Chinese phenotype is 20–30 cm long, oblong with bluntly tapering ends and pale green in color, with a gently undulating, warty surface. Some bear miniature fruit of only 6–10 cm in length, which may be served individually as stuffed vegetables (Kumar *et al*., 2010).It is cultivated during the warm season i.e., during April to July (Upadhyay *et al*., 2015).Sowing dates have also been found to greatly influence vegetative (emergence to first flowering time) and reproductive growth stages (flowering to pod maturity time) of crops (Akther *et al*., 2013). When emergence rate for each sowing date was calculated using a common base temperature, they were found to be well correlated with rate of change of day length. Time of sowing determines the time of flowering, and it has great influence on dry matter accumulation, seed set and seed yield (Sofield, 1977).In one study, sowing dates had the significant effect on seed yield of this plant, so that the highest seed yield (551 g plot-1) was obtained when seeds were sown on March 23, which was 155.44% higher than the lowest seed yield produced by sowing on April 22 (216 g plot^{-1}) and the optimum sowing date was late February to late March (Huang et al. 2010). Rahman *et al*. (2014) investigated a study to select the optimum sowing date for quality seed production of bitter gourd and to find out a relationship between seed quality parameters and prevailing weather condition. Six different sowing dates viz., 1 October, 1 November, 1 December, 1 January, 1 February and 1 March were used in this study. Results revealed that there was significant difference on fruits per plant, seeds per fruit, 100 seed weight and seed yield per ha. Seed yield of the bitter gourd increased gradually from 1 November sowing to 1 February sowing. Moreover, Hassan *et al*. (2008) indicated that the highest values of plant height, number of leaves/plant, fresh and dry weight per plant, chlorophyll a, b, a + b were shown at the early sowing date (15th October) than the other studied sowing dates (15th November and 15th December) in Beta vulgaris.In a study on the effect of three planting date (May 10, May 31 and June 20) on morpho-physiological traits of roseles (*Hibiscus sabdariffa*), Seghatoleslami *et al*. (2013) found that the highest plant height, stem diameter, branch number was obtained at the sowing date of May 10. This treatment also showed better seed quality in respect to the seed germination (93.33%) and vigor index (10.66).Hajseyedhadi *et al*. (2002) reported that yield of chamomile was affected by sowing date, and it was decreased by later sowing. To increase yield and its stability, it is necessary to take into consideration to determine the optimum sowing date for achieving higher yield of plant (Ahmed et al., 2015). Therefore, it is clear that date of sowing plays a great role in the production of the plants. Keeping in view of these facts, the present investigation was carried out to study the effects of sowing date on the morphological traits and fruit yield of the bitter gourd (*Momordica charantia* L.).

ARPN Journal of Agricultural and Biological Science

MATERIALS AND METHOD

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.

Field was prepared with the length of 43 m and with the width of 95 m 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 such as weeding, irrigation, fertilizer, hoeing was done regularly during the growing season.

At the time of flowering and end of vegetative growth, 10 plants from each plot were randomly selected and harvested and the number of leaf per plant and height of these selected plants, were recorded. After harvesting of selected fruits, the number of fruits was counted for each treatment.Diameter and length of fruits were measured with a caliper and ruler respectively. Fruits were dried in the shade and fruits yield was measured using a carriage scale using standard moisture at 14%. 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

Plant height

According to the results of analysis of variance (Table-1), the simple effect of sowing date treatment on the plant height, was significant ($p \leq 0.01$). The results of Figure-1 showed that the maximum measure of this attribute (2.20 m) was related to the sowing date of May 22, and the minimum measure of this trait (0.93 m) was achieved by the sowing date of January 21. While height of plants from the sowing date of September 23 was placed between maximum and minimum Plant height.

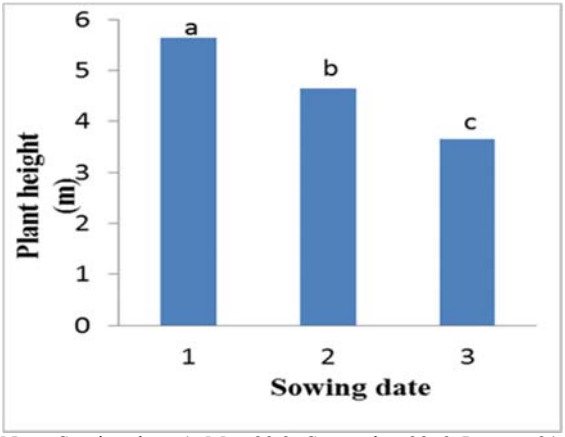
Table-1. Physicochemical properties of soil.

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

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

						Mean squares	
Sources of variation	**df**	**Plant height**	**Number of leaf per plant**	**Number of fruit per plant**	**Length of fruit**	**Diameter of fruit**	**Yield of dried fruit**
Replication	2	0.524**	0.33ns	2.33*	0.128ns	0.002 ns	119766.45 ns
Sowing date	2	1.21**	21756**	4.00*	33.71**	0.667**	8569260.52**
Error	4	0.02	880.33	0.33	o.86	0.003	126001.07

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



Note: Sowing date: 1- May 22,2- September 23, 3-January 21

Figure-1. Effect of sowing date on height of the bitter gourd.

Number of leaf per plant

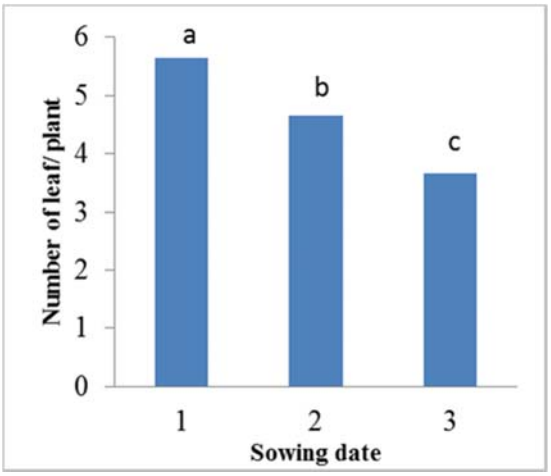
The results of analysis of variance showed that effect of sowing date on the number of leaf per plant was significant at the probability level $P \leq 0.01$ (Table-1). A significant variation in the number of leaf per plant was observed in case of sowing date. So that May 22 sowing produced the maximum number of leaf per plant (264) while it was the lowest (94) on January 21 sowing (Fig-2).

Number of fruit per plant

According to the results in Table-1, the effect of different sowing date on the number of fruit per plant had significant effect at the probability level $P \leq 0.05$. As the results of mean comparison (Figure-3) shows, clearly that treatment of May 22 with the amount of 5.33, had the highest number of fruit per plant while treatments of sowing September 23 and January 21 with the amounts of 3.3, had the lowest number of fruit per plant.

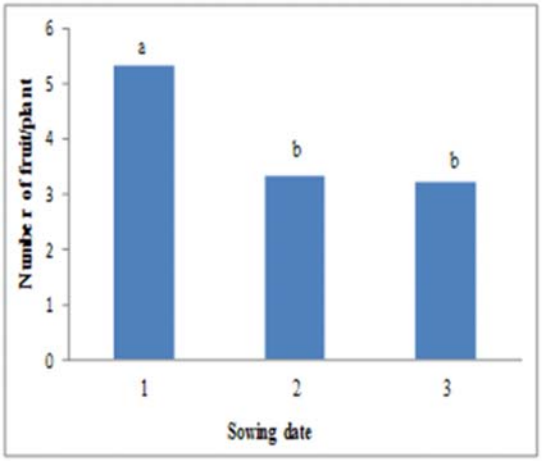
Length of fruit

The results of analysis of variance (Table-1) indicated that the effect of sowing date treatment on the length of fruit was significant (P≤0.01). Length of fruit varied significantly due to different sowing date. It was found that the earlier sowing (May 22) produced the maximum length of fruit (14.40 cm) which was statistically different from the other treatments whereas the minimum length of fruit was recorded from September 23 (10.27 cm) and January 21 (7.17 cm) sowing (Figure-4).



Note: Sowing date: 1- May 22,2- September 23, 3-January 21

Figure-2. Effect of sowing date on the leaf number of bitter gourd.

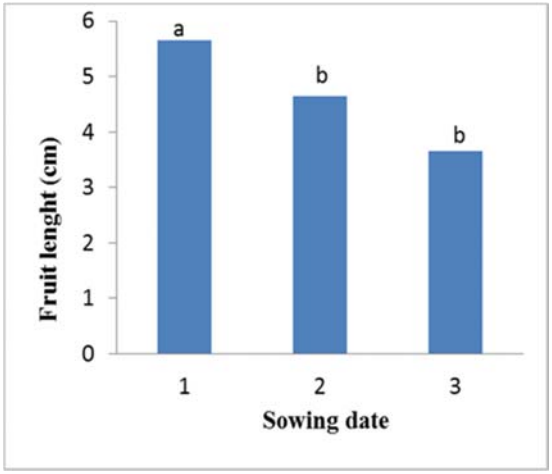


Note: Sowing date: 1- May 22,2- September 23, 3-January 21

Figure-3. Effect of sowing date on the fruit number ofbitter gourd.

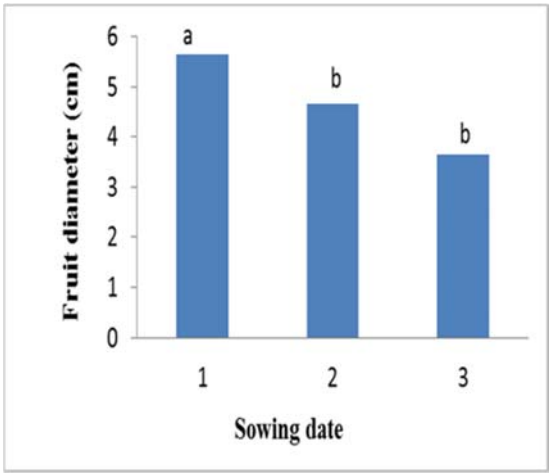
Diameter of fruit

Simple effect of sowing date on the diameter of fruit was significant at p ≤ 0.01 (Table-1). The results for the mean comparison (Figure-5), demonstrated that the highest diameter of fruit (4.84 cm) was obtained from the sowing date of May 22 and while the minimum amount of this trait was achieved by treatment of January 21 (4.08 cm) which was statistically similar to the treatment of September 23 (3.97 cm) sowing.



Note: Sowing date: 1- May 22,2- September 23, 3-January

Figure-4. Effect of sowing date on the fruit length of the bitter gourd.

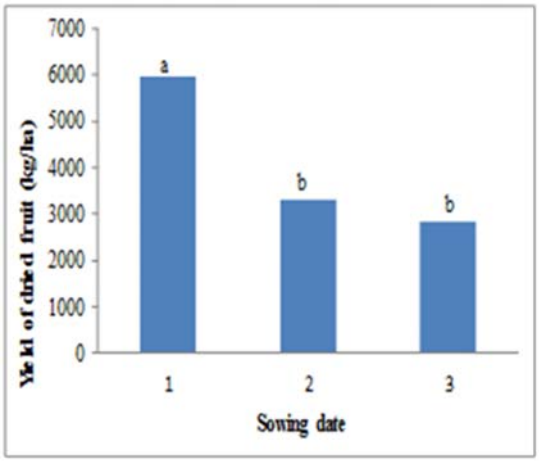


Note: Sowing date: 1- May 22,2- September 23, 3-January 21

Figure-5. Effect of sowing date on the diameter fruit ofthe bitter gourd.

Yield of dried fruit

According to the results of analysis of variance (Table-1), the effect of sowing date treatment on yield of dried fruit of bitter gourd plant, was significant at p ≤0.01. The results of means comparison (Figure-6) showed that, plants from the sowing date of May 22, had the highest yield of dried fruit (5976 $kg.ha^{-1}$), while the treatments of sowing September 23 (3304.7 $kg.ha^{-1}$) and January 21 had the minimum (2846.8 kg. ha^{-1}) dried fruit yield.



Note: Sowing date: 1- May 22,2- September 23, 3-January 21

Figure-6. Effect of sowing date on the dried fruit yield of the bitter gourd.

DISCUSSIONS

Results of this experiment showed that traits of the number of fruit per plant, length and diameter of fruit, plant height, number of leaf per plant and yield of dried fruit were affected by sowing date. In this case, Iraddi (2008) emphasized, optimum sowing time plays an important role to fully exploit the genetic potential of a variety as it provides optimum growth conditions such as temperature, light, humidity and rainfall. Moreover, Pandey *et al*. (1981) revealed that sowing at proper time allows sufficient growth and development of a crop to obtain a satisfactory yield and different sowing dates provide variable environmental conditions within the same location for growth and development of crop and yield stability. In this experiment, the leaf number increasing in early planting date (May 22) in comparison with the later sowing dates (September 23 and January 21) is probably because of prolonged photosynthesis by transforming light energy into active electrons and chemical activity in the chloroplasts in early planting date (May 22) and this increasing photosynthesis efficiency, motivated the rubiscoactivase complex and increased carbon photosynthesis and therefore, increased number of leaf per plant and plant height. Seghatoleslami *et al*. (2013) showed that sowing date has the significant effect on plant height and with delaying the sowing date thischaracter decreased significantly. According to the results of this experiment, the number of fruit per plant was significantly affected by sowing date. It can be said that with the decreased temperature and shortened days under the delayed sowing (September 23 and January 21), the plants did not haveenough time for vegetative growth and production of ample branches, and so the number of fruit per plant decreased. First sowing date (May 22)increased fruit length, diameter and yield in compared to the third sowing date (January 21), because the first sowing date had higher leaf area index and photosynthesis potential at the time of the maximum solar radiation in the region (during May) which increased their vegetative growth and the support for production at reproductive growth stage, while, with the delay in sowing date, vegetative period decreased, and the plants faced shortened days and declined radiation. Therefore, it seems that longer vegetative period of the first sowing date effects on biological yield (such as higher plant height, number of leaf per plant) as well as production of bigger fruits with greater canopy and more assimilates allowed the plants to support more fruits per plant. This amplification could increase dry matter and fruit yield. Consistent with the results of this experiment, Hassan *et al*. (2008) indicated that the highest values of plant height, number of leaf/plant, fresh and dry weight per plant, chlorophyll a, b, a + b were shown at the early sowing date. Moreover, Russo (1995) reported that the sequential planting from early May in South-Central USA was a viable method of increasing the marketable yield of bell peppers.

CONCLUSIONS

From the above results, it is revealed that yield traits of bitter gourd differed with different dates of planting.The highest number of fruit per plant (5.33), length (14.40 cm) and diameter of fruit (4.84 cm), plant height (2.20 m), number of leaf per plant (264) and yield of dried fruit (5976 kg. ha^{-1}) were obtained by planting date on May22. The final results of this experiment showed that May 22 sowing would be the optimum sowing date for the maximum production of the bitter gourd at konarak, Iran.

REFERENCES

Ahmed B., Sultana M., Zaman J., Kumar Paul S., Rahman M., Islam R. and Falguni Majumdar F. 2015. Effect of sowing dates on the yield of sunflower. Bangladesh agronomy journal. 18: 1-5.

Akhter S., Singh L., Saxena A., Rasool R., Jan R. and Showqi I. 2016. Agro meteorological indices for brown sarson (*Brassica rapa* L.) sown under different dates of sowing in temperate region of Kashmir. The Bioscan. 11(1): 279-283.

Bown D. 1995.The herb society of America encyclopedia of herbs and their uses. (1st ed.,) Dorling Kindersley Publishing Inc, New York. p. 135.

Cifuentes Z., Custardoy L., De la Fuente JM., Marquina C., Ibarra MR., Rubiales D. and Pérez-de-Luque A. 2010. Absorption and translocation to the aerial part of magnetic carbon-coated nano-particles through the root of different crop plants. Journal of Nanobiotechnology. 8: 26.

Haj SeyedHadi M, NoormohammadiGh, Sinaki JM, Khodabandeh N, Yasa N, Darzi MT. 2004. Effects of planting time and plant density on flower yield and active substance of Chamomile (*Matricaria chamomilla* L.). 4th International Crop Science Congress p. 280.

Hassan WM., Almaghraby OA., Sakr MM. 2008. Effect of sowing dates and vernalization on Beta volgaris cv. univers .A Growth and some chemical components of the leaf.Agricultural Research Journal, Suez Canal University. 8(2): 35-40.

Huang R, Fang F, Zhuang F, Kang H, Huang Y, Lou H. 2010. Sowing date, plant density, fruits per plant and harvest time influenced yield and quality of hybrid seed of bitter gourd (*Momordica charantia*). Acta Horticulturae. 871: 395-402.

Iraddi VS. 2008. Response of mustard (*Brassica juncea* L. Czernj and Cosson) Varieties to date of sowing and row spacing in northern transition zone of Karnataka. Thesis Submitted to the University of Agricultural Sciences, Dharwad In partial fulfilment of the requirements for the Degree of Master of science (Agriculture) In Agronomy. pp. 55-81.

Islam Sh, Jalaluddin M. and Hettiarachchy N.S. 2011. Bio-active compounds of bitter melon genotypes (*Momordica charantia* L.) in relation to their physiological functions. Functional Foods in Heals and Disease: 2:61-74.

Kumar SD, Vamshi Sharathnath K, Yogeswaran P, Harani A, Sudhakar K, Sudha P, David Banji. 2010. A medicinal poteney of Momordica charantia. International Journal of Pharmaceutical Sciences Review and Research. 1(2): 95-100.

Upadhyay A., Agrahari P. and Singh DK. 2015.A Review on Salient Pharmacological Features of Momordicacharantia.International Journal of Pharmacology. 11(5): 405-413.

Kirtikar KR. and Basu BD. In: E. BlatterJF., Caius KS. Mhaskar (2ndEds.), Indian medicinal plants. Allahabad, India: Lalit Mohan Basu; 1993. p. 1182.

Pandey BP., Sirvastava SK. and Lal RS. 1981. Genotype and environment interaction in lentil. Lens. 8: 14-17.

Rahman MS, Islam MN, Shaheb MR, Sarker PC, Nessa A. and Sarker MH. 2014. Influence of sowing date on quality seed production of bitter gourd. International journal of sustainable crop production. 9(2):17-21.

Russo VM. 1996. Planting date, fertilizer rate, and harvest timing affect yield of Jalapeno and Banana peppers. American Society for Horticultural Science. 31(7):1097-1118.

Seghatoleslami MJ., Mousavi SG. and Barzgaran T. 2013. Effect of irrigation and planting date on morpho-physiological traits and yield of rosell (*Hibiscus sabdariffa*) The Journal of Animal and Plant Sciences. 23(1): 256-260.

Sofield K., Evans LT., Cook MG. and Wardlaw F. 1977. Factors influencing the rate and duration of grain filling in wheat.Australian Journal of Plant Physiology. 4: 785-797.

Wills RBH, Wong AWK., Scriven FM, Greenfield H. 1984. Nutrient composition of Chinese vegetables.Journal of Agricultural and Food Chemistry. 32: 413-416.