Effect of date of sowing on yield, yield attributes and heat use efficiency of brinjalin western region of Haryana

ABSTRACT

AField experiment was conductedduring autumn-winter season of 2020 at Vegetable Science Research Farm of Chaudhary Charan Singh Haryana Agricultural University, Hisar to examine the impact of growing environment on yield and heat use efficiency of different varieties of brinjal crop. The experiment was conducted in Factorial Randomized Block Design with four dates of transplanting (5, 15, 25 July and August 4) and three varieties (Hisar Shymal, HLB-12and BR-112) with three replications of each. Yield and yield attributes along with heat use efficiencyunder different growing environment have been worked out. The maximum fruit length, fruit weight and fruit diameter was obtained on D_2 - 15th July, 2020 transplanted crop. The maximum fruit length among varieties was recorded in variety HLB-12 while maximum fruit weight, fruit diameter was recorded in Hisar Shyamal which was significantly higher than other two varieties. The maximum fruit yield/plant and yield/ha was recorded in D_2 - 15th July, 2020 transplanted crop.Among the varieties, maximum yield/plant and yield/ha was recorded in variety Hisar Shyamal.The maximum heat use efficiency was attained in D1 - 5th July, 2020 transplanted crop of brinjal (by acquiring its required GDD in lesser number of days). Among the varieties, the maximum heat use efficiency was exhibited by the brinjal variety Hisar Shyamal. The brinjal variety 'Hisar Shyamal'reported here to be more thermal energy/ heat use efficient when transplanted early on 5th July.

Keywords:Brinjal, Heat use efficiency, Growing degree days, Yield attributes, Yield

INTRODUCTION

Brinjal (*Solanum melongena* L.), one of the most significant solanaceous vegetable crops and it is also known as eggplant.Vegetables provide the body with vital nutrients, vitamins, and minerals and are the best means of overcoming micronutrient deficiency, so known as protective foods.Brinjal fruits are rich in vitamins, including vitamin B, calcium, phosphorus, and iron and its green leaves are the main source of antiscorbutic Vitamin C.Compared to other vegetable crops, brinjal is a good source of protein. Due to its high concentration of vitamins, minerals, and health-promoting bioactive substances, it is regarded as one of the healthiest vegetables with a very low calorie count (Docimo *et al.*, 2016). Additionally, white brinjal has some medical qualities; for example, it helps individuals with liver problems and diabetes. If the fruits are used after being fried in oil, it also relieves toothaches (Chen and Li., 1997). Vegetables crops are also sensitive to climatic variables such as temperature, precipitation and light (Adedapo, 2017). Thus, crop-climate relationship needs to be taken into account in order to increase vegetable crop productivity.Autumn-winter is the popular season, which stretches from August to February, there are a number of improved and high-yielding brinjal varieties that do better because of reduced insect pest incidence (Nath *et al*., 2008) and suitable weather, such as low to moderate nighttime temperature without any heavy showers in the first few days following anthesis (Singh and Kalda, 2000). In order to investigate the agrometeorological feasibility and standardize the production technique in the autumn-winter season, the current study was conducted.

MATERIALS AND METHODS

The field experiment was conductedduring autumn-winter season 2020 at Research Farm of Department of Vegetable Science, CCS Haryana Agricultural University, Hisar.The experiment was laid out in Factorial Random Block Design. The treatments were randomly allocated to different plots with four dates of transplanting(D□-5th July, D□-15th July, D□-25th July and D□-4th August) and three varieties of Brinjal(V□-Hisar Shymal, and V□-HLB-12 and V□-BR-112)with three replications of each.Five fruits were picked at the edible/marketable stage from randomly chosen plants in each replication plot. The length of each fruit was measured in centimeter using a scale, diameter of each fruit was also measured in centimeters but with the help of digital verniarcaliper meterWeight of all fruits is measured in gramsand then average of all these parameters was computed. By using the total weight of all the fruits harvested from five randomly chosen competitive plants in each replication's plot yield/plant was computed, by dividing the total weight by the number of plants .The weight of the fruits from each pickingwas noted individually in grams for every replication. After the last picking fruit weight of all the picking was added and yield quintal per hectare was computed**.**Heat use efficiency (HUE) was calculated as per Rao *et al*(1999) as the ratio of fruit yield/ha and growing degree days (ΣGDD) at final harvest. It can be expressed by the following formula:

HUE = Fruit yield (kg ha^{-1})/ GDD (^{0}C day)

Growing degree days (GDD) were determined as per Nuttonson (1955) by summing the daily mean temperature above base temperature and are expressed in ^{0}C day. This was calculated using the following formula:

$$\text{Growing degree days}(^0\text{C day}) = \sum_{a}^{b} \left(\frac{(T_{max} + T_{min})}{2} - T_b \right)$$

Where,

a = Date of start of a phenophase
b = Date of end of a phenophase
$T_{max.}$ =Daily maximum temperature (^{o}C)
$T_{min.}$ =Daily minimum temperature (^{o}C)
T_b = Base temperature (10 ^{o}C, Senshan*et al*., 1995)

RESULTS AND DISCUSSION

Yield attributes and yield of brinjal varieties in different growing environments

The experiment resultsfor fruit length, weight and diameter have been shown in Table 1. The maximum fruit length (11.16 cm),maximum weight (105.59 gm) andmaximum fruit diameter (6.3 cm) was obtained in crop transplanted on D_2 - 15th July, 2020 which was significantly higher among all other dates of transplanting while among varieties maximum fruit length was recorded in HLB-12 (16.44 cm) which was also significantly higher than other two varieties (Hisar Shyamal and BR-112) of brinjal cropwhile maximum fruit weight (126.50 gm) and maximum fruit diameter (7.54 cm) was recorded in Hisar Shyamal which was significantly higher than HLB-12.

Table 1. Effect of date of sowing and varieties onfruit diameter, fruit length and fruit weight of brinjal

Treatments	Fruit diameter (cm)	Fruit length (cm)	Fruit weight (gm)
Dates of transplanting			
D_1: 5th July, 2020	6.11	10.94	104.07
D_2: 15th July, 2020	6.30	11.16	105.59
D_3: 25th July, 2020	6.01	10.89	104.28
D_4: 4th August, 2020	5.92	10.89	103.83
SE(m)	0.055	0.067	1.348
C.D. at 5 %	**0.16**	**0.19**	**NS**
Varieties			
V_1: Hisar Shyamal	7.54	8.16	126.50
V_2: HLB-12	3.38	16.44	58.97
V_3: BR-112	7.32	8.08	126.34
SE(m)	0.04	0.06	1.16
C.D. at 5%	**0.14**	**0.17**	**3.44**

Fruit yield

The experimental results for yield/plant and yield (q/ha) are depicted in table-2.The maximum fruit yields were recorded in D_2 - 15th July, 2020 with value 1.00 kg/plant and 271.22 q/hawhich were significantly higher than the yield attained in D_3 - 25th July, 2020 and D_4 - 4th August, 2020,andclosely followed by D_1 - 5th July, 2020 transplanted crop. Among the varieties, maximum yields were recorded in variety Hisar Shyamal with value 1.00 kg/plant and 276.81 q/ha which were significantly higher than other two varieties of brinjal.

Table 2. Effect of date of sowing and varieties on yield of brinjal crop

Treatments	Fruit yield (Kg/plant)	Fruit yield (q/ha)
Dates of transplanting		
D_1: 5th July, 2020	0.98	270.94
D_2: 15th July, 2020	1.00	271.22
D_3: 25th July, 2020	0.90	247.10
D_4: 4th August, 2020	0.89	236.00
SE(m)	0.02	5.23
C.D. at 5 %	**0.06**	**15.44**
Varieties		

V_1: Hisar Shyamal	1.00	276.81
V_2: HLB-12	0.93	244.03
V_3: BR-112	0.90	248.11
SE(m)	0.018	4.53
C.D. at 5%	**0.05**	**13.37**

Heat use efficiency (HUE)

The heat use efficiency exhibited by brinjal varieties under different growing environment is shown in fig. 1. The maximum heat use efficiency was attained in D_1- 5th July, 2020transplanted crop with value of 22.18 Kg/ha□C day which was significantly higher than D_3 - 25th July, 2020 and D_4- 4th August, 2020 while closely followed by D□- 15th July, 2020 transplanted crop. Among the varieties, the maximum heat use efficiency was exhibited by Hisar Shyamal with value of 22.41 Kg/ha□C day which was significantly higher than other two varieties.

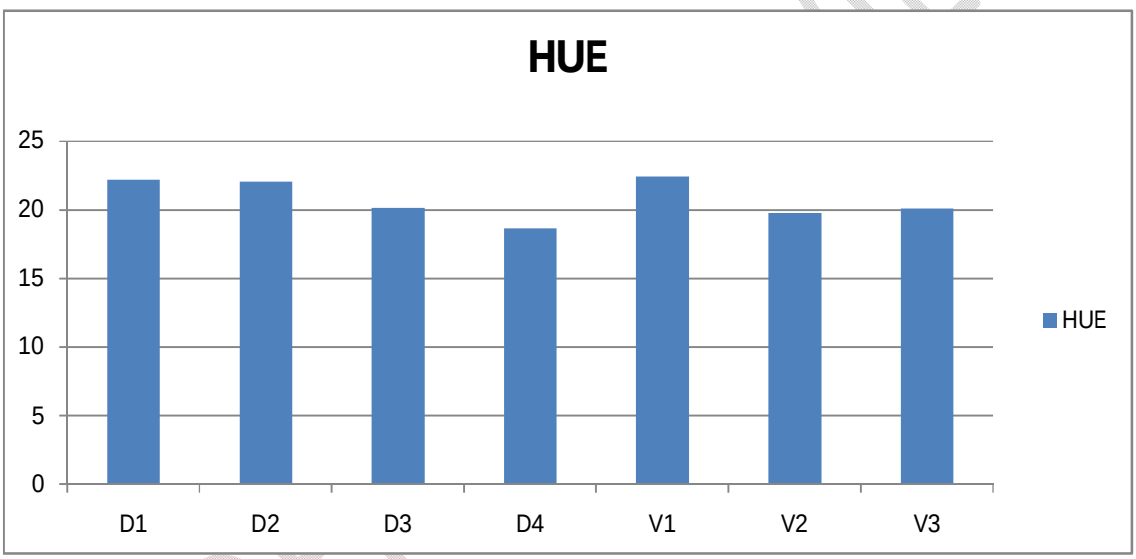

Fig.1. Heatuse efficiencies(Kg/ha□Cday) in brinjal varieties under different growing environments

CONCLUSION

On the basis of results obtained from the above study, it may be concluded thatHisar shyamal variety of brinjal crop is higher yielder in prevalent environmental conditions and 15th July found to be most suitable period for transplanting of brinjal seedlings which resulted into maximum yield attributes and yield in brinjal crop. The maximum heat use efficiency was attained in crop transplanted on 5th July 2020.Brinjal variety 'Hisar Shyamal'reported here to be more thermal energy/ heat use efficient when transplanted early on 5th July.

REFERENCES

Adedapo, A. (2017). Impact of climate variability on vegetable crops in Ilorin, Kwara State,Nigeria. *Ruhuna Journal of Science*. **8**(1).15-19.

Chen, N. C., and Li, H. M. (1996). Cultivation and breeding of eggplant. In *Training workshop on vegetable cultivation and seed production technology* (No. RESEARCH). AVRDC.

Dhankhar, S. K., and Chandanshive Aniket, V. (2017) Energy requirements for attainment of different phenological stages in broccoli inbreds. *The Horticultural Society of India (Regd.),* **74**(4): 623-626.

Docimo T., Francese G., Ruggiero A., Batelli G., De Palma M. and Bassolino L. (2016). Phenylpropanoids accumulation in eggplant fruit: characterization of biosynthetic genes and regulation by a MYB transcription factor. Front. *Plant Science.* **6**:1233-1238.

Kumar, R., Kaundal, M., Vats, S. K., and Kumar, S. (2012). Agrometeorological indices of white clover (*Trifolium repens*) in western Himalayas. *Journal of Agrometeorology*. **14**(2):138-142.

Nath, P., Srivastava, V. K., Dutta, O. P., & Swamy, K. R. M. (2008). *Vegetable crops: improvement and production* (No. BOOK). Dr. Prem Nath Agricultural Science Foundation.

Nuttonson, M.Y. 1955. Wheat climate relationships and use of phenology in ascertaining the thermal and photothermal requirement of wheat. American Institute of Crop Ecology, Washington DC, pp 338.

Rao, V.U.M., Singh, D. and Singh, R. 1999. Heat use efficiency of winter crops in Haryana. Journal of Agrometeorology 1(2) : 143-8.

Rithichai, P., Fujime, Y., Sukprakarn, S., Terabayashi, S., Okuda, N., and Date, S. (2004). Effects of photoperiod on flower bud initiation of some okra (*Abelmoschus esculentus*) cultivars in spring and autumn. *Journal of the Japanese Society for Horticultural Science*. ***73***(4): 312-318.

Singh, N. and Kalda, T.S. (2000). Brinjal, *In*:Text book of vegetables, tuber crops and spices (Eds) S. Thamburaj and N. Singh, ICAR, New Delhi, p31.

Yang, S. (1993). Studies on procedures for calculating the base temperature and effects of temperature regimes on tomato transplant development and yield. The University of Tennessee.