Advances in Crop Science and Technology
ISSN: 2329-8863
Research Article Open Access

Effect of Planting Date on Onion (*Allium cepa L*) Bulb Production under Irrigation Condition in Wolaita Zone Southern Ethiopia

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Abstract

Onion (*Allium cepa L*) is one of the most popular vegetables in the world. It is a recently introduced bulb crop in the agriculture community of Ethiopia and it is rapidly becoming a popular vegetable among producers and consumers. Like in many other countries, temperature is noted to be as one of the most important environmental factors that affect onion dry bulb and seed production in Ethiopia. Timing of planting date is hence important so that every developmental phase may occur at times when temperature is favorable for crop performance and high yields can be obtained. Therefore, the current study was carried out in order to investigate effects of planting dates on onion bulb production under irrigation conditions in Wolaita Zone, Ethiopia. Field experiments were carried out in Wolaita Zone to investigate effects of planting dates on onion bulb production under irrigation condition using RCBD design replicated three times. Five different planting dates with fifteen days intervals, starting from mid September to mid November, were used as treatments. The major data collected were subjected to analysis of variance using SAS software by the command PROC GLM. The analyses of variances indicated that both growth and yield parameters measured were significantly affected by planting date in the study area. The highest plant height (54cm) and leaf number (9.3) were recorded from onion planted at mid October. Maturity of onion was more prolonged (154.3 days) when planted at mid-September and shortened (134.3 days) when planted at mid November. Higher number of marketable bulb (240,972), marketable yield (29.58 t ha^{-1}) and total yield (35.83 t ha^{-1}) were obtained from planting onion at mid October. In general, it can be concluded that onion yield tended to increase when planted under irrigation starting from mid-September to mid October in the study area. Hence, onion growing farmers in the study area should be advised to plant onion in between period of mid-September to mid-October so as to get more onion bulb.

Keywords: Planting date; Onion, Bulb yield; Irrigation

Introduction

At present, following tomatoes, onion (*Allium cepa* L) is one of the most popular vegetables in the world. It is a recently introduced bulb crop in the agriculture community of Ethiopia and it is rapidly becoming a popular vegetable among producers and consumers. The crop is produced as a cash crop by small farmers and commercial growers especially under irrigated conditions compared to the traditional bulb crops, shallot and garlic, which are rain-fed. Onion is valued for its distinct pungency or mild flavors and form essential ingredients of many dishes. It is consumed in small quantity in many homes almost daily as a seasoning or flavoring of varieties of dishes, sauces, soup, sandwiches, etc. in many countries of the world. It is naturally packaged vegetables consisting of fleshy, concentric scales that are enclosed in paper-like wrapping leaves, connected at the base by flattened stem disc [1].

Temperature controls the development and the performance of the onion plant in all its growth phases [2]. According to [3], onion seedlings grow the best at temperatures between 20 and 25°C. For optimum vegetative growth a temperature between 18 and 22°C is needed. From bulb initiation up to harvesting, higher temperature between 25 and 28°C are required.

Like in many other countries, temperature is noted to be as one of the most important environmental factors that affect onion dry bulb and seed production in Ethiopia. The crop requires cool condition during early development and warm conditions during bulbing, bulb maturity, harvesting and curing stages. Onion bulbs have specific temperature requirements for seed and bulb production [4]. Timing of planting date is hence important so that every developmental phase may occur at times when temperature is favorable for crop performance and high yields can be obtained. Planting date plays an important role in onion crop performance [5].

There had been no recommendation on appropriate planting date for onion bulb production in the specific study area under irrigation. Farmers plant onion haphazardly. Some farmers plant it in September while others plant in October and some others in November. Hence, the current study was carried out in order to investigate effects of planting dates on onion bulb production under irrigation within the existing climatic conditions of *Humbo* District, Wolaita Zone.

Objective

To determine appropriate planting date for better onion bulb production under irrigation in Humbo District, Wolaita Zone, South Ethiopia

Materials and Methods

Description of study site

The study was carried out in *Wolaita* zone, *Humbo* district between September to March in 2018 and 2019. *Wolaita* zone is located between 06°30′–07°12′N 037°14′–038°7′E [6]. It covers an altitude range of 700–2900 m above sea level, having a bimodal rainfall [7]. Mean annual

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Received: 19-May -2023, Manuscript No: acst-23-99328, **Editor assigned:** 23-May-2023, PreQC No: acst-23-99328 (PQ), **Reviewed:** 14-June -2023, QC No: acst-23-99328, **Revised:** 23- June-2023, Manuscript No: acst-23-99328 (R) **Published:** 30- June-2023, DOI: 10.4172/2329-8863.1000585

Citation: Toas Z, Boto N (2023) Effect of Planting Date on Onion (*Allium cepa L*) Bulb Production under Irrigation Condition in Wolaita Zone Southern Ethiopia. Adv Crop Sci Tech 11: 585.

rainfall of the study area is 1001 mm with the lowest and highest record in January and August, respectively. The mean monthly maximum and minimum temperature is 27^{0}c and 14^{0}c, respectively. The last twenty two years' monthly mean values of rainfall and temperature are shown below (Figures 1 and 2) [8].

Soils of the zone are varying due to its diverse topography. The dominant soils of the zone are reported to be Nitisols with clay loam texture [9]. It is derived from a multistory ignimbrite substratum, deep and has a good general porosity, a high capacity to absorb rainfall water and a high infiltration speed [10].

Experimental materials

An improved onion variety named Bombay Red was used as a test crop. Urea (46%N) and NPS blended fertilizers with recommended rates (100kg urea and 200kgNPS ha^{-1}) were used as the sources of Nitrogen and Phosphorus, respectively. Irrigation water was applied as per farmers' practice uniformly for all treatments. All other cultural operations like nursery raising, main field preparation, transplanting, weeding, plant protection etc. were carried out as per the recommendations in order to obtain a successful crop [11].

Treatments and experimental design

Five treatments of various planting dates were used with fifteen days intervals:

Treatment 1: Planting at mid of September

Treatment 2: at end of September

Treatment 3: at mid of October

Treatment 4: at end of October and

Treatment 5: at mid of November. The experiment was laid out as RCB design with three replications.

Data collection and analysis

Five plants per plot were randomly selected from middle rows to measure the major growth parameters. Plant height was measured from the soil surface to the tip of the pseudo stem and mean plant height was calculated. Number of leaves per plant was recorded by counting the number of leaves per plant and the average was recorded. During harvesting number of marketable bulb per plot was counted and, by using sensitive balance, marketable and total fruit yield was measured. The collected data were subjected to analysis of variance (ANOVA) for RCB Design using the SAS software by the command PROC GLM version 9.2 [12]. Least Significant Difference (LSD) test at 5% probability was used to separate means when the F test was significant.

Results and Discussion

Effect of planting date on growth of onion crop

Onion plant height, number of leaves and days to maturity were highly significantly ($p<0.05$) affected by planting date. The longest plant height (54.0cm) and more leaves per plant (9.3) were observed with onion planted at mid-October. Prolonged days to maturity (154.3) were observed in planting date of mid-September, whereas the shortest days to maturity (35.1) were recorded in planting onion at mid-November. In general, late planting showed a significant reduction in plant height, number of leaves as well as days to maturity of onion (Table 1). This may be due to the existing temperature differences of the respective months that hastened maturity (Figure 2). It is usual that the effect of planting time in relation to change of temperature of the environment is reflected primarily in plant growth.

Effects of planting date on onion bulb yield

Except marketable bulb numbers, both marketable and total bulb yield of onion were not significantly ($p>0.05$) influenced by planting

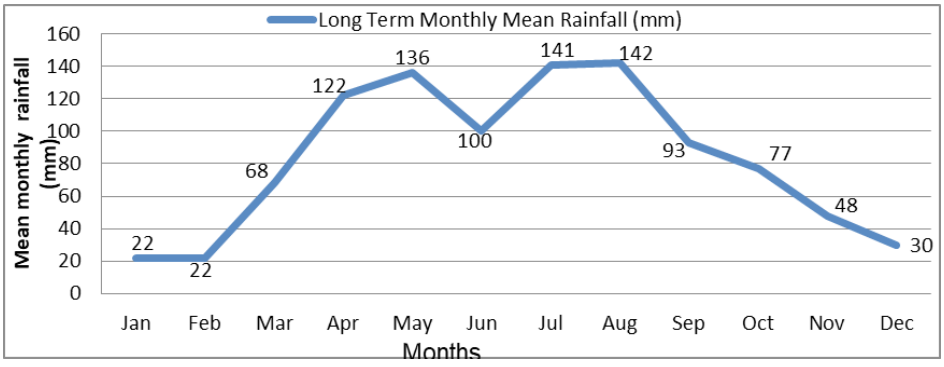

Figure 1: Long term (1996-2018) monthly mean rainfall amount.

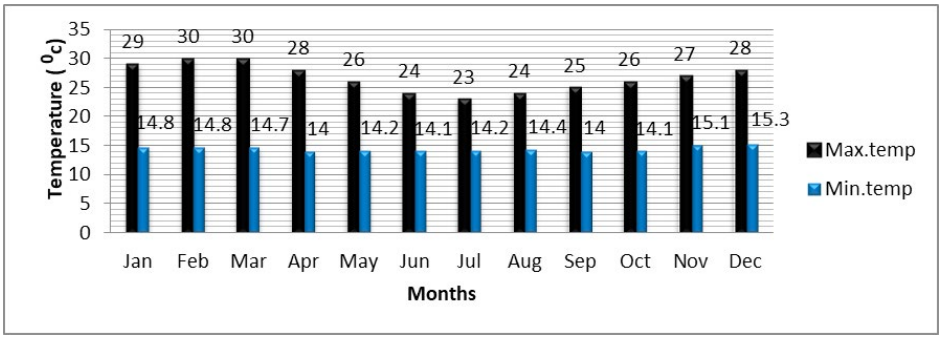

Figure 2: Long term (1996-2018) monthly mean maximum and minimum temperature.

Table 1: Effects of planting date on onion plant height, number of leaves and days to maturity.

Planting date	Plant height (cm)	Number of leaves per plant	Days to maturity
Mid-September	47.3	7.6	154.3
End September	50.7	8.3	150.3
Mid October	54.0	9.3	145.7
End October	40.8	5.6	138.7
Mid November	35.1	5.7	134.3
LSD(0.05)	8.1	1.4	3.5
CV (%)	9.5	10.2	1.3

Table 2: Effect of Planting Date on Marketable Bulb Number (MBN), Marketable Bulb Yield (MBY) and Total Bulb Yield (TBY) of Onion in Humbo district, 2018.

Planting date	MBN	MBY(t ha^{-1})	TBY (t ha^{-1})
Mid-September	390,278	26.74	29.65
End September	450,695	30.04	33.09
Mid October	650,347	32.43	35.35
End October	633,681	31.53	34.83
Mid November	657,986	31.77	35.24
LSD(0.05)	85,286	NS	NS
CV (%)	1.1	3.0	2.4

date in the year 2018 whereas in the year 2019 all parameters were significantly ($p<0.05$) affected by planting date. Though the treatments showed no parity statistically in the year 2018, the highest marketable bulb number, marketable bulb yield and total bulb yield were observed with planting onion at mid of October in both years (Table 2 and Table 3). The simple linear correlation coefficients for major parameters measured were significantly different from zero at the 5% probability level. The significant high r values indicated that there was strong evidence that the growth and yield parameters were highly associated with one another. Except number of marketable bulb, both marketable and total yields were significantly and positively correlated with growth parameters. Marketable bulb yield (0.71**) and total bulb yield (0.72**) both were highly and positively correlated with plant height. Similarly, marketable bulb yield (r = 0.84**) and total bulb yield(r = 0.84**) were strongly and positively correlated with leaf number. Marketable bulb yield (r = 0.58 *) and total bulb yield (r = 0.53 *) were significantly and positively correlated with number of marketable bulbs. Moreover, total bulb yield (r = 0.98 **) was strongly and positively correlated with marketable bulb yield. Generally, the result of this study showed that onion yield tends to increase when planted starting from mid-September to mid-October and declines then after. This result agrees with Lemma and Shameless (2003) who reported the results of studies carried out at different areas in Ethiopia that yield of onion showed declining trend starting from planting in month September to month November.

Conclusion

The results of the experiment revealed highly significant responses of growth and yield parameters of onion to planting date. Both plant height and number of leaves were significantly influenced by planting date. The highest plant height and more leaf number were recorded from onion planted at mid-October. Maturity of onion was more prolonged when planted at mid-September and shortened when planted at mid-November. Higher marketable and total bulb yield were obtained from planting onion at mid-October. In general, it can be concluded that onion yield tended to increase when planted starting from mid-September to mid-October in the study area. Therefore, planting onion under irrigation starting from mid of September to mid of October could be recommended as one of the best agronomic practices for farmers so as to obtain higher bulb yield in the prevailing environmental conditions of the study area.

Competing Interests

The authors declare that they have no competing interest

Acknowledgement

The authors are grateful to Southern Agricultural Research Institute and Areka Agricultural Research Center for covering the costs and other logistics supports during the field experiment, though there is no financial support at all for publishing the article.

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