

Growth and Bulb Yield of Onion (*Allium cepa* L.) in Response to Plant Density and Variety in Jimma, South Western Ethiopia

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Abstract

In appropriate use of plant spacing and lack of evaluation of improved varieties across agro ecologies are the predominant agronomic practices that reduce the productivity of onion. The present study therefore, has been designed to investigate the influence of variety, intra-row spacing and their possible interaction on growth and yield of onion. The study was conducted under irrigation during the year 2016/2017 at Jimma University College of Agriculture and Veterinary Medicine, on experimental site of horticultural crops. Four onion varieties (Adama Red, Nafis, Melkam and Nasik Red) and three intra-row spacing (7, 10 and 13 cm) with inter-row spacing of 20 cm. The experiment was designed in RCBD with three replications. The results of the study showed that both variety and intra-row spacing had a significant effect ($P < 0.05$) on all parameters, except for the leaf diameter which was only affected by intra-row spacing. Leaf number per plant was significantly affected by interaction of variety and intra-row spacing. The highest leaf number (13.9) obtained from variety Nafis with intra-row spacing of 13 cm. In general, leaf number per plant, leaf length, plant height and leaf diameter were higher at wider intra-row spacing (13 cm). Nafis variety was superior in terms of leaf number per plant (13.9), bulb diameter (5.67 cm), average bulb weight (74.50 g), marketable yield (36.26 t ha⁻¹) and total bulb yield (36.28 t ha⁻¹). Onion plant grown at closer intra-row spacing (7 cm) showed very promising result for average bulb weight, marketable yield and total tuber yield. Moreover, the closest intra-row spacing (7 cm) gave higher marketable and total bulb yield than the wider intra-row spacing. Thus, growers in the study area can be benefited from closer intra-row spacing, however, it is paramount important to test the feasibility of the other closest intra-row spacing e.g., 6 cm and 4 cm.

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Keywords: Onion (*Allium cepa* L.); Variety; Adama red; Nafis; Melkam; Intra-row spacing; Growth; Bulb and yield

Onion is one of the most important vegetables in the world. It belongs to the family *Alliaceae* [1]. It is originated in central Asia and Afghanistan where some of its relatives still grow. It is a recently introduced crop to Ethiopia from Sudan and then distributed to different parts of the country and now became important vegetable crop for markets and in a daily life of people the country [2].

Onion is valued for its distinct pungency or mild-favoured form of essential ingredient in many cuisines and

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contradicting reports show that optimum plant density for a certain variety is highly site specific and need further study to give concrete recommendation across locations including Jimma zone. Therefore, the study was designed to determine the optimum population density for better plant growth and yield for different onion varieties under Jimma condition and to determine the possible interaction of variety and plant population for plant growth and yield of onion.

The experiment was conducted at Jimma University College Agriculture and Veterinary Medicine on experimental site during the year 2016/17 under irrigated condition. The area is situated in Oromia region, Jimma zone in south western part of Ethiopia. It is located at an elevation of 1710 m above sea level and at 7°42' 9"N latitude and 36°47' 6" E longitudes in Ethiopia. The experimental site receives an average annual rainfall of 1495mm with maximum and minimum temperatures of 26.5°C and 12°C, respectively. The soil of the experimental site is reddish brown clay classified as Nitisol with pH range of 5.0 to 6.0 [12].

Four improved onion varieties (Melkam, Nafs, Adama Red and Nasik Red) were used in the study. The seeds of these varieties were obtained from Melkasa Agricultural Research Centre in 2016.

The treatment consists of four onion varieties (Adama Red, Nafs, Nasik Red, and Melkam) and three intra-rows spacing (7, 10 and 13 cm). Inter-row spacing was maintained at 20 cm. A total of twelve treatments were arranged in 4 × 3 factorial combination in randomized complete block design (RCBD) with three replications. Each treatment combination was assigned randomly to the experimental units within blocks. In general, there were 36 experimental units (plots).

intra-row spacing whereas the closest intra-row spacing leads to strong competition for nutrient and moisture and thereby cause shorter plant. Yemane [15] and Tesfalegn [11] reported similar results in which the highest leaf length was obtained from wider intra-row spacing.

Variety	Intra- row spacing (cm)		
	7	10	13
Adama Red	7.8 ^h	11.0 ^d	12.7 ^{bc}
Nafis	8.1 ^g	11.9 ^{cd}	13.9 ^a
Melkam	8.4 ^{gh}	8.4 ^{gh}	13.7 ^{ab}
Nasik Red	9.3 ^{gh}	10.2 ^{ef}	11.9 ^{cd}
LSD (5%)	1.19	1.19	1.19
CV (%)	6.29	6.26	6.26

Table 1: Leaf number of onion as influenced by interaction of variety and intra-row spacing. LSD (5%)=Least significant difference at P=0.05, CV (%)=Coefficient of variation in percent, means with the same letter(s) within a column are not significantly different at 5% of significance.

Plant height: Variety and intra-row spacing had a significantly effects on plant height ($P<0.0001$; Table 2). The interactions between variety and intra-row spacing, on the other hands, did not show significant differences. Variety

smaller space for bulbing [22]. T e present fnding is in line with Nigulle and Biwas [23] who found the highest bulb diameter from wider intra-row spacing.

Treatment	BL (cm)	BD (cm)	ABW (g)
Variety			
Adama Red	5.85 ^a	5.18 ^b	62.88 ^c

As an intra-row spacing level increased from 7 to 13 cm the marketable bulb yield decreased. The highest marketable bulb yield (38.93 t ha^{-1}) was obtained from plants grown at 7 cm intra-row spacing. An intra-row spacing 13 cm showed the lowest marketable bulb yield (25.21 t ha^{-1}). However, the weight of individual bulb at 13

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