

Effect of different levels of NPK and Micronutrients for plant growth, bulb and quality of onion (*Allium cepa*) in NFT System at hydroponics.

Abstract:-

The present experiment was carried out during 2021-22 in Central Horticulture Research Farm of Department of Horticulture, SHUATS, and Prayagraj. The experiment was conducted in Randomized Block Design with 7+1 (Control) with 3 replications. The treatments were T₀ Tap water, T₁ (8.12ml NPK/Pl), T₂ (9.37ml NPK/Pl), T₃ (10.62ml NPK/Pl), T₄ (11.87ml NPK/Pl), T₅ (13.12ml NPK/Pl), T₆ (14.37ml NPK/Pl), T₇ (15.62ml NPK/Pl). From the present investigation it is found that treatment T₇ (15.62ml NPK/Pl) was found to be best in terms of Plant length, Number of leaves, diameter and weight of bulb, girth of bulb, days to maturity, Days to flowering, days to maturity, average fresh weight, neck thickness at maturity, sensory evaluation, Nitrogen %, Sulphur%, TSS, ascorbic acid, dry matter content, moisture content and cost benefit ratio.

Keywords: Onion, NPK, Hydroponics, Growth, Yield.

Introduction

Onion (*Allium cepa* L.) belongs to family Alliaceae and is one of the most important marketable vegetable crops cultivated considerably in India and world. It's an necessary item in every kitchen as spice, vegetable as well as salad, thus, commands considerably in internal request. Onion is preferred for its flavour and pungency which is due to the presence of a unpredictable sulphur emulsion allyl propyl disulphide. Onion bulb is a rich source of protein, carbohydrates, vitamin C and minerals like phosphorus, calcium, etc. (Yadav et al., 2015). India is the second largest patron of onion in the world, coming to China, counting for 27.05 of the area and 22.6 of the world product. In India, onion occupies about 1.20 million hectare area under civilization with total product of 19.40 million Mt and productivity of 16.1 Mt/ha (Anonymous, 2014). The nonstop and imbalanced use of inorganic diseases is negatively affecting the sustainability of agrarian product besides causing environmental pollution Greenland (1975) suggested that for a sustainable crop product system, chemical nutrients removed by the crop must be replenished and physical conditions of the soil maintained. Integrated nutrient operation (INM) provides excellent openings to overcome all the imbalances besides sustaining soil health and enhancing crop product. It optimizes the benefits from all possible sources of factory nutrients in an

intertwined manner. lately, organic nutrient operation has got rapid-fire instigation due to knowledge of health hazard and environmental safety. Organic manures not only balance the nutrient force but also ameliorate the physical and chemical parcels of soil (Nair and Peter, 1990). Deficiency of micronutrients during the last three decades has grown in both, magnitude and extent. This has come a major constraint to product and productivity of vegetables in general and onion in particular. therefore, there's an critical need for correction of individual nutrient insufficiency and for arresting its farther spread. The lower productivity of Indian onion is primarily due to civilization of low yield implicit kinds mongrels, vulnerability to both biotic (pests and conditions) and abiotic factors (i.e. humidity stress, high temperature, imbalance nutrition etc). thus, imbalanced nutrition is treated as one of the major abiotic stress which negatively affects crop growth and yield in onion.

For optimal growth and development, bulb onions require temperature range of 12 – 25 °C and annual rainfall of 350 – 600 mm on well drained medium textured soils with a pH range of 6 – 7 (Muendo and Tschirley, 2004) to achieve optimum yield of 17 Mg/ha (Jaetzold *et al.*, 2009).

One method of farming that can be applied to growing the onions is the hydroponic method. Hydroponics is a method of planting the crops without using soil. In simple terms, in hydroponics a plant utilizes water, nutrients, and oxygen. Hydroponics method is an alternative solution to cultivate vegetables in limited land. The changes in air temperature, light composition, plant temperature and humidity greatly affect hydroponic growth. The difficulty of knowing the environmental conditions of hydroponic planting media often makes the farmers who use this planting method to fail in the middle of the process of plant growth.

Materials and Method

The area of Prayagraj district comes under subtropical belt in the south east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46o C-48o C and seldom falls as low as 4oC- 5oC. The relative humidity ranges between 20 to 94 %. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

The experiment was conducted in Randomized Block Design with 7+1 (Control) with 3 replications. The treatments

were T0 Tap water, T1 (8.12ml NPK/Pl), T2 (9.37ml NPK/Pl), T3 (10.62ml NPK/Pl), T4 (11.87ml NPK/Pl), T5 (13.12ml NPK/Pl), T6 (14.37ml NPK/Pl), T7 (15.62ml NPK/Pl).

Result and Discussion

The maximum plant was recorded in the Treatment T7 (15.62ml NPK/Plant) with (44.50) cm followed by treatment T5 (13.12ml NPK/Plant) with (43.20) cm and minimum was recorded in the treatment T0 Control (Tap water) with (23.00) cm.

The maximum number of leaves was recorded in the Treatment T7 (15.62ml NPK/Plant) with (7.62) followed by treatment T5 (13.12ml NPK/Plant) with (6.78) and minimum was recorded in the treatment T0 Control (Tap water) with (5.03) number of leaves.

The maximum diameter of bulb was recorded in T7 (15.62ml NPK/Plant) with (17.65) mm which was followed by T5 (13.12ml NPK/Plant) with (16.39) mm which was significantly superior over T0 Control (Tap water) with (11.32) mm.

The maximum girth of bulb was recorded in T7 (15.62ml NPK/Plant) with (7.95) mm which was followed by T5 (13.12ml NPK/Plant) with (7.21) mm which was

significantly superior over T0 Control (Tap water) with (4.12) mm.

The maximum weight of bulb was recorded in T7 (15.62ml NPK/Plant) with (4.95) g which was followed by T5 (13.12ml NPK/Plant) with (4.82) g which was significantly superior over T0 Control (Tap water) with (2.98) g.

The maximum neck thickness was recorded in the Treatment T7 (15.62ml NPK/Plant) with (7.56) mm followed by treatment T5 (13.12 ml NPK/Plant) with (7.21) mm and minimum was recorded in the treatment T0 Control (Tap water) with (5.53) mm.

The minimum days to maturity was recorded in T7 (15.62ml NPK/Plant) with (71.65) days which was followed by T5 (13.12ml NPK/Plant) with (72.15) days which was significantly superior over T0 Control (Tap water) with (82.39) days.

The maximum T.S.S. was recorded in T7 (15.62ml NPK/Plant) with (7.05) OB which was followed by T5 (13.12ml NPK/Plant) with (6.92) OB which was significantly superior over T0 Control (Tap water) with (6.02) OB.

The maximum ascorbic acid was recorded in T7 (15.62ml NPK/Plant) with (12.06) mg/100g which was followed by T5

(13.12ml NPK/Plant) with (11.57) mg/100g which was significantly superior over T0 Control (Tap water) with (9.26) mg/100g.

The maximum score of Pungency was recorded in T7 (15.62ml NPK/Plant) with (8.59) which was followed by T5 (13.12ml NPK/Plant) with (8.31) which was significantly superior over T0 Control (Tap water) with (6.92).

The maximum score of taste was recorded in T7 (15.62ml NPK/Plant) with (8.62) which was followed by T5 (13.12ml NPK/Plant) with (8.02) which was significantly superior over T0 Control (Tap water) with (6.79).

The maximum average fresh weight of bulb was recorded in the Treatment T7 (15.62ml NPK/Plant) with (65.50) g which was followed by T5 (13.12ml NPK/Plant) with (61.87) g which was significantly superior over T0 Control (Tap water) with (40.37) g.

The maximum Yield/Treatment was recorded in T7 (15.62ml NPK/Plant) with (1.57) kg which was followed by T5 (13.12ml NPK/Plant) with (1.48) kg which was significantly superior over T0 Control (Tap water) with (0.85) kg.

The maximum Neck thickness was recorded in T7 (15.62ml NPK/Plant) with (7.10) mm which was followed by T5 (13.12ml

NPK/Plant) with (7.05) mm which was significantly superior over T0 Control (Tap water) with (5.31) mm.

The maximum dry matter content (g) was recorded in the Treatment T7 (15.62ml NPK/Plant) with (16.95) g followed by treatment T5 (13.12ml NPK/Plant) with (14.61) g and minimum was recorded in the treatment T0 Control (Tap water) with (9.25) g.

The maximum moisture content % was recorded in the Treatment T7 (15.62ml NPK/Plant) with (81.35) % followed by treatment T5 (13.12ml NPK/Plant) with (70.35) % and minimum was recorded in the treatment T0 Control (Tap water) with (69.62) %.

Table 1 Effect of NPK and Micronutrients on Plant height, number of Leaves, bulb diameter, bulb girth and bulb weight on onion in NFT system under Prayagraj agro climatic conditions.

Treatment	Plant Height						Number of Leaves						Bulb Diameter(mm)	Bulb Girth (mm)	Bulb weight(g)
	Initial	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	Initial	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP			
T₀	10.65	12.34	15.67	19.42	21.08	23.00	2.01	2.8	3.26	4.05	4.85	5.03	11.32	4.12	2.98
T₁	12.62	15.21	26.32	30.08	34.21	38.92	2.06	2.91	3.62	4.16	5.06	5.54	13.25	5.62	3.34
T₂	13.75	16.34	27.35	29.34	33.14	39.12	2.12	3.06	4.05	4.62	5.21	5.61	12.92	5.92	3.39
T₃	15.62	19.34	29.16	30.15	36.21	40.62	2.1	3.21	4.16	4.38	5.62	5.86	13.86	6.34	3.61
T₄	14.25	21.26	30.45	33.62	38.62	41.32	2.31	3.61	4.72	4.92	5.73	5.95	15.05	6.79	3.92
T₅	16.35	23.16	31.28	37.46	40.35	43.2	2.95	4.12	5.13	5.84	6.32	6.78	16.39	7.21	4.82
T₆	15.92	22.34	30.92	34.16	39.65	42.3	2.56	3.95	5.06	5.62	6.02	6.23	14.26	7.06	4.71
T₇	18.36	25.34	33.61	39.42	42.28	44.5	3.1	4.35	5.95	6.32	6.72	7.62	17.65	7.95	4.95
F-Test	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
S.E.(d)	0.006	0.046	0.013	0.013	0.008	0.014	0.005	0.001	0.001	0.002	0.152	0.003	0.011	0.004	0.007
CD @ 5%	0.012	0.016	0.028	0.028	0.018	0.029	0.001	0.002	0.002	0.004	0.329	0.005	0.024	0.009	0.015
CV	0.047	0.007	0.057	0.057	0.029	0.042	0.024	0.03	0.03	0.045	3.161	0.05	0.097	0.077	0.229

Table 2 Effect of NPK and Micronutrients on Neck thickness, Days to maturity, TSS, ascorbic acid, sensory evaluation, average fresh weight, yield per treatment, Neck thickness, dry matter content and Moisture content.

Treatment	Neck thickness			Days to Maturity	TSS °Brix	Ascorbic acid (mg/100g)	Sensory Evaluation		Average Fresh Weight of bulb (g)	Yield per Treatment (kg)	Neck Thickness (mm)	Dry Matter Content (g)	Moisture Content %
	25 DAT	50 DAT	75 DAT				Taste	Pungency					
T ₀	3.12	4.26	5.53	82.39	6.02	9.26	6.79	6.92	40.37	0.85	5.31	9.25	70.35
T ₁	4.05	5.02	6.09	80.65	6.37	9.67	7.09	7.21	55.10	1.32	5.92	11.64	73.62
T ₂	4.62	5.21	6.12	81.43	6.56	10.35	7.32	7.61	56.90	1.37	6.02	13.29	75.29
T ₃	5.42	5.79	6.67	79.86	6.83	11.10	7.72	7.52	57.67	1.38	6.10	12.91	77.62
T ₄	5.61	5.91	6.86	78.28	6.78	11.21	7.86	7.97	59.47	1.43	6.21	14.06	74.25
T ₅	5.81	6.13	7.21	72.15	6.92	11.57	8.02	8.31	61.87	1.48	7.05	14.61	79.62
T ₆	5.73	6.02	7.06	75.35	6.75	11.06	7.92	8.12	62.97	1.51	6.91	13.64	71.35
T ₇	5.92	6.49	7.56	71.65	7.05	12.06	8.62	8.59	65.50	1.57	7.10	16.95	81.35
F-Test	S	S	S	S	S	S	S	S	S	S	S	S	S
S.E.(d)	0.002	0.006	0.005	0.166	0.008	0.002	0.007	0.009	0.006	0.091	0.002	0.005	0.175
CD @ 5%	0.003	0.012	0.011	0.359	0.017	0.004	0.015	0.018	0.013	0.197	0.004	0.01	0.379
CV	0.039	0.123	0.094	0.266	0.139	0.021	0.113	0.139	0.161	0.055	0.04	0.045	0.285

Conclusion

From the present investigation it is concluded that the treatment T₇ (50, 55, 60, 65, 70, 75 ml/10 L) was found to be best in the terms of growth, yield and quality parameters of the onion in NFT system in agro-climatic conditions of Prayagraj.

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