

Effect of Spacings, Fertilizer Levels and Their Interaction on Growth Yield Attributes and Tuber Yield of Sweet Potato under Paddy Fallows

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Abstract

A field experiment was conducted during summer 1993-94 to find the influence of spacings and fertilizer (NPK) dose on growth and yield of sweet potato under paddy fallows. Treatments were compared for three levels each, of nitrogen (50, 75 and 100 kg/ha), phosphorus (25, 50 and 75 kg/ha) and potassium (50, 75 and 100 kg/ha) with selected combinations of their along with a control, besides three intra row spacings (30, 45 and 60 cm) and constant inter row spacings (60 cm). Among the various combinations of spacing (intra row spacing) and fertilizer doses, 30 cm or 45 cm of intra row spacing with 75 : 50 : 75 kg NPK per hectare recorded highest tuber yield (20.37 and 19.44 t/ha, respectively) in sandy loam soil under paddy fallows.

Key words : Sweet potato, Spacing, Fertilizer levels, Growth, Yield.

Sweet potato *Ipomoea batatas* (L.) Lam. is an important tuber crop of tropical and sub-tropical regions. It is also a subsidiary food crop in coastal Karnataka, which is grown to an extent of 12, 000 ha in the state (1). Nutritionally it is a valuable food crop and is well known for starch and is often called forages of nutrients. It is a good source of carbohydrates and could also be a substitute for rice and wheat (2). Spacing, an important factor which determines the optimum crop stand, is variable to a great extent under different climatic and edaphic conditions, including soil fertility. So, fixing a perfect balance between fertilizer dose and spacing is atmost important to realize higher yields of sweet potato. Keeping these points in view, it was considered necessary to find out the influence of spacing and NPK levels on growth and yield of sweet potato.

Methods

A field experiment was conducted during Summer 1993-94 at the Regional Research Station, Vishveshwaraiah Canal Farm, Mandya with sweet potato variety, Accession No. 7 as a test variety. The soil of the experiment site was sandy loam with high organic carbon content (0.99%), high available phos-

phorus (53 kg/ha, P_2O_5) and medium available potassium (219 kg/ha, K_2O). The design adopted for the experiment was randomized complete block design with 12 combinations of spacing and fertilizer (NPK) dosage (replicated thrice). The treatments consisted of three levels each of nitrogen (50, 75 and 100 kg/ha), phosphorus (25, 50 and 75 kg/ha) and potassium (50, 75 and 100 kg/ha) along with a control and their selected combinations with three intra row spacing (30, 45 and 60 cm) with a constant inter row spacing of 60 cm.

Half the dose of nitrogen and full dose of phosphorus and potassium were applied as basal dose at the time of planting (urea, super phosphate and muriate of potash were used as source of N, P and K respectively).

Growth observations were recorded periodically and yield observations at harvest. A few pertinent observations are used for the purpose of discussion in this chapter. The data were statistically analyzed and discussed at five per cent probability level.

Results and Discussion

Fertilizer dose and the interaction of fertilizer dosage and spacing had a significant influence on

Table 1. Effect of spacings, fertilizer levels and their interactions on growth yield attributes and tuber yield of sweet potato. NS—Non-significant.

Treatment	Vine length at harvest (cm)	Leaf area per plant at (80 DAP) (sq/cm)	No. of tubers per plant	Tuber length (cm)	Tuber girth (cm)	Tuber yield (g/plot)	Harvest index	Tuber yield (t/ha)
Spacings (cm)								
S ₁ (60 × 30)	175.33	8219.20	8.64	17.81	2.80	1179.10	0.6454	17.07
S ₂ (60 × 45)	190.22	9154.80	8.30	17.64	2.93	1091.60	0.6144	16.67
S ₃ (60 × 60)	210.76	10141.60	8.80	17.56	3.18	986.83	0.5780	16.15
CD (<i>P</i> =0.05)	3.73	481.27	0.28	NS	0.14	58.49	0.0047	NS
SE ±	1.27	164.08	0.29	00.08	0.04	19.94	0.0140	00.10
Fertilizer (N : P : K kg/ha) Levels								
F ₁ (0 : 0 : 0)	151.86	5245.00	6.02	15.54	2.02	444.27	0.436	11.65
F ₂ (50 : 25 : 50)	183.04	8210.50	7.97	17.80	2.83	933.44	0.5985	16.74
F ₃ (75 : 50 : 75)	207.44	10414.30	10.19	21.09	3.30	1522.67	0.6963	19.45
F ₄ (200 : 75 : 100)	227.00	12817.40	9.19	16.25	3.73	1443.00	0.6717	18.67
CD (<i>P</i> =0.05)	4.31	555.72	0.33	0.32	0.16	67.54	0.0160	1.09
SE ±	1.46	189.46	0.11	0.10	0.05	23.02	0.0055	0.37
Interaction : Spacings (cm) × Fertilizer (N : P : K kg/ha) Levels								
S ₁ F ₁	148.47	4369.30	6.27	15.45	1.96	423.07	0.4811	11.34
S ₁ F ₂	170.40	7953.60	8.30	18.00	2.54	1198.33	0.6839	17.59
S ₁ F ₃	180.53	9360.60	10.50	21.34	3.18	1616.67	0.7231	20.37
S ₁ F ₄	201.93	11193.20	9.50	16.45	3.53	1478.33	0.6933	18.98
S ₂ F ₁	151.83	5515.50	6.00	15.54	1.95	439.73	0.4791	11.57
S ₂ F ₂	182.37	8204.30	7.87	17.63	2.87	906.67	0.6012	16.67
S ₂ F ₃	180.53	9360.60	10.50	21.34	3.18	1616.67	0.7231	20.37
S ₂ F ₄	201.93	11193.20	9.50	16.45	3.53	1478.33	0.6933	18.98
S ₃ F ₁	151.83	5515.50	6.00	15.54	1.95	439.73	0.4791	11.57
S ₃ F ₂	182.37	8204.30	7.87	17.63	2.87	906.67	0.6012	16.67
S ₃ F ₃	207.77	10769.20	10.20	21.15	3.23	1540.00	0.6900	19.44
S ₃ F ₄	221.70	12130.00	9.13	16.25	3.68	1480.00	0.6782	18.98
S ₄ F ₁	155.27	5850.20	5.80	15.64	2.17	470.00	0.4906	12.04
S ₄ F ₂	196.37	8473.60	7.73	17.78	3.08	695.33	0.5102	15.97
S ₄ F ₃	234.03	11113.20	9.87	20.78	3.50	1411.33	0.6668	18.53
S ₄ F ₄	257.37	15129.10	8.93	16.06	3.99	1370.67	0.6436	18.05
CD (<i>P</i> =0.05)	8.31	962.50	0.57	NS	0.26	116.98	0.0282	1.88
SE ±	2.74	328.16	0.19	00.18	0.09	39.88	0.0095	0.64
CV%	2.60	6.20	4.00	01.90	5.30	6.40	2.7000	6.70

tuber yield, whereas spacing alone showed no significant influence on tuber yield of sweet potato. Among fertilizer levels, NPK dose of 75 : 50 : 75 kg/ha resulted in significantly higher tuber yield (19.45 t/ha) as compared to lower dose of NPK (Table 1). Further increase in fertilizer levels did not increase tuber yield.

With regard to the interaction of spacing and

fertilizer level, the highest tuber yield was recorded with S₁F₃ (60 × 30 cm and 75 : 50 : 75 kg NPK/ha) which was 20.37 t/ha. However, this was also at par with the treatments S₁F₄ (60 × 30 cm and 100 : 75 : 100 kg NPK/ha). S₂F₃ (60 × 60 cm and 75 : 50 : 75 kg NPK/ha). Rest of the spacing, fertilizer level combinations were significantly inferior to these treatments. Thus, sweet potato requires medium to higher levels of NPK

depending on spacing, and lower levels such as 50 : 25 : 50 kg NPK/ha are not helpful in maximizing the yields. Between the two higher levels of fertilizer, i. e., 75 : 50 : 75 and 100 : 75 : 100 kg NPK /ha maximum yields could be obtained even with 75 : 50 : 75 kg NPK/ha, when wider spacings such as 60 × 45 or 60 × 60 were adopted.

Apart from moderately high growth parameters and superior yield parameters, fertilizer dose of 75 : 50 : 75 kg NPK/ha had higher harvest index, either alone or in combination with plant densities, thus contributing towards tuber yield. On the other hand, increasing fertilizer dose 100 : 75 : 100 kg NPK/ha) resulted in lower harvest index due to excessive vegetative growth. These results are in accordance with the findings of Stino and Lashin (3) who opined that fertilizer dose beyond certain limit was found to reduce tuber yield, even though it improved plant growth.

When spacing was increased in combination with fertilizer dosage it was found to contribute less from each individual plant by producing small sized tuber, though produced more tuber yield per unit area. On the other hand, when spacing was increased it was found to contribute more from individual plant by way of producing big sized number of plants per hectare, which provided proper space for optimum development and ensured adequate water and nutri-

ents uptake at a given fertilizer level, but produced less tuber yield per unit area. This lend support to the findings of Shrafuddin and Voican (4) who opined that the accommodation of appropriate number of plants per hectare, which provides proper space for optimum development and ensures adequate water and nutrients uptake at a given fertility level.

With this, it can be concluded that,keeping the inter row spacing constant (60 cm), narrow intra row spacing (30 × 45 cm) can be practiced with the fertilizer dosage of 75 : 50 : 75 kg NPK/ha. This could be a better combination of spacing and fertilizer dose for higher tuber yield in sweet potato in sandy loam soil under paddy fallows.

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