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Effect of Time of Planting on Growth, Yield and Economics of Sweet Potato Under Rainfed Conditions

Sweet potato (*Ipomoea batatas* (L.) Lam.) is an important starchy food crop. It is the seventh most important food crop, which produces high edible energy per unit area per unit time as compared to rice, wheat, maize and cassava (Saikia and Borah, 2007). It is eaten after boiling, baking and frying. It is also candied with syrup or used as a 'Puree'. Tubers of sweet potato are utilized for canning, dehydrating and flour making. Apart from being a food crop, sweet potato is also utilized for feeding livestock. The vines serve as a good source of fodder for livestock. In India, the leading states in terms of area and production of sweet potato are Orissa, Bihar, Uttar Pradesh, Maharashtra, Karnataka and Madhya Pradesh. In India, particularly in the state of Madhya Pradesh, sweet potato is mostly cultivated by small and marginal farmers having low investment capacity. Climate conditions, particularly temperature and photoperiod exert great influence on the growth and development of sweet potato vines and tubers. Besides, under rainfed cultivation, soil moisture is another important factor, which depends upon total quantity and distribution of precipitation. During the growing period, a range of temperature between 20-30°C is favourable for tuber formation and high yield, whereas, high temperature between 30-40°C, high rainfall, long days and low light intensity promotes vine growth (Verma and Naskar, 1990). Changes in starch properties of sweet potato tubers do occur with different dates of planting and harvesting (Noda et al., 2000).

Field experiments were carried out during 2001 and 2002 at five locations (Algoda, Puchkundi, Rithori, Tihari and Teori villages) in Jabalpur region to determine the suitable time of planting for sweet potato. Three dates of planting (1st July, 15th July and 1st August) were tested in Randomized Block Design with 10 replications. About 30-40 cm long cuttings of sweet potato variety, J.S. 114, were planted at 60 cm inter row and 30 cm intra row spacing in flat beds in the well prepared fields. Each cutting was buried in the soil keeping two nodes above the soil surface. Farmyard manure @10 t ha^{-1} and NPK@ 50:30:50 kg ha^{-1} were applied in all the plots. Half dose of N and full dose of P and K were given at the time of planting. Remaining half dose of N was applied as top dressing 45 days after planting. Thereafter, standard package of practices were followed. Observations on survival of cuttings, length of main shoot, number of branches, number of tubers per plant, girth of tuber, length of tuber, fresh weight of tubers per plant and tuber yield were recorded. Economics was worked out on the basis of prevailing prices of inputs and produce during the period of experiment. The crop was harvested during the fourth week of November during both the years. The weather data during the period of experimentation was recorded at the Meteorological Observatory, College of Agricultural Engineering, Jabalpur. During 2001, the average maximum temperature, minimum temperature, maximum relative humidity, minimum relative humidity and rainfall were 30.7°C, 21.0°C, 90%, 60% and 1157 mm respectively. During 2002, these were 31.2°C, 21.3°C, 84.8%, 54.5% and 1130.2 mm, respectively.

Different planting dates had significant effect on the growth attributes (Table 1). There was an increase in survival of cuttings with delay in planting up to 1st August. Maximum survival of cuttings was observed with 1st August planting. Higher temperature and low humidity during the first fortnight of July might be the reason for low survival of the cuttings. Length of main shoot of vine was reduced with delay in planting. Maximum length of vine was measured with 1st July planting which was on par with 15th July planting. Planting on 1st August produced shortest vines. Availability of shorter favourable period for vegetative growth in the case of late plantings might be the reason for lesser vine growth. Maximum

Table 1. Effect of time of planting on growth and yield parameters of sweet potato

Date of planting	Survival of cuttings (%)		Length of main shoot (cm)		Number of branches		Number of tubers per plant		Girth of tuber (cm)		Length of tuber (cm)		Fresh weight of tubers per plant (g)	
	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002
1^{st} July	75.52	70.25	338.2	325.4	5.31	5.16	4.12	3.85	17.19	17.10	14.35	14.53	488.3	482.3
15^{th} July	82.76	79.30	326.4	316.2	4.82	4.65	4.83	4.76	21.23	20.85	16.12	16.32	554.6	551.8
1^{st} August	91.64	92.51	296.8	305.8	4.78	4.62	5.86	5.67	20.15	20.56	17.89	17.95	523.2	546.7
CD (0.05)	5.97	5.82	13.01	11.35	0.15	0.09	0.21	0.24	0.92	10.69	1.72	1.78	28.33	26.65

number of branches was observed under 1^{st} July planting. Planting on 15^{th} July and 1^{st} August showed no significant difference in the number of branches but both were significantly lower as compared to 1^{st} July planting.

The yield attributes were also significantly influenced by time of planting (Table 1). Planting of sweet potato cuttings on 1^{st} August produced maximum number of tubers per plant followed by 15^{th} July and 1^{st} July planting. Maximum tuber girth was observed under 15^{th} July, which was on par with 1^{st} August planting. Minimum girth of tuber was observed under 1^{st} July planting. Planting on 1^{st} August produced longer tubers followed by 15^{th} July planting. Planting of sweet potato on 1^{st} July produced smaller tubers. Fresh weight of tubers per plant was higher when planted on 15^{th} July, which was followed by 1^{st} August planting. The lowest fresh weight of tubers per plant was obtained under 1^{st} July planting.

Higher growth and yield parameters contributed to higher total tuber yield under 15^{th} July and 1^{st} August planting (Table 2). Both these treatments showed significantly higher total tuber yield over 1^{st} July planting. This may be ascribed to the availability of favourable weather conditions i.e. higher temperature and humidity at vegetative growth stage and lower humidity and temperature at tuber bulking stage to the crop planted on 1^{st} August. Dayal and Sharma (1993) and Nedunchezhiyan and Byju (2005) also reported remarkable influence of planting time on growth and yield of sweet potato. But the marketable tuber yield was the highest under 1^{st} August planting followed by 15^{th} July planting. The lowest marketable tuber yield was found under 1^{st} July planting. Economic analysis (Table 2) indicated that highest gross income, net income as well as cost: benefit ratio was obtained under 1^{st} August planting which was followed by 15^{th} July planting.

It can be concluded that sweet potato can be planted from 15^{th} July to 1^{st} August under rainfed conditions for maximum benefits.

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Table 2. Effect of time of planting on yield and economics of cultivation of sweet potato

Date of planting	Tuber yield (t ha^{-1})						Gross costs (Rs ha^{-1})		Gross income (Rs ha^{-1})		Net income (Rs ha^{-1})		Cost : benefit ratio	
	Marketable		Weevil infested		Total									
	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002
1^{st} July	12.5	11.3	4.8	4.6	17.4	15.9	39166	39285	50152	50782	10986	11497	1:1.28	1:1.29
15^{th} July	17.4	16.8	2.8	2.7	20.2	19.6	39166	39285	69568	75753	30402	36468	1:1.78	1:1.92
1^{st} August	18.9	18.1	1.2	1.2	20.1	19.3	39166	39285	75812	81517	36646	42232	1:1.94	1:2.07
CD (0.05)	1.87	1.96	0.78	0.8	1.54	1.81								

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