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Growth and Dry Matter Production of Chinese Potato during Off - season as Influenced by Date of Planting and Nutrient Management

Chinese potato (*Plectranthus rotundifolius*) is a minor tuber crop belonging to the family Labiatae. The plant is a small herbaceous bushy annual growing to a height of 30-60 cm. It has succulent stem and aromatic leaves. Leaves are petiolate, opposite and rounded to ovate in shape with serrated margins. The tubers are used as vegetable and possess good keeping quality compared to other vegetables. The tubers are preferred for their particular aromatic flavour and sweetness. The tubers can be used as medicine for curing dysentery and in the treatment of certain eye disorders (Mohankumar*et al*., 2000). The tubers are not only rich in carbohydrates or starch, but also rich in minerals like calcium and iron and certain vitamins including thiamine, riboflavin, niacin and ascorbic acid.

The recommended time of planting of Chinese potato is from July to October (KAU, 2011) since it is a season bound crop. The Kerala Agricultural University has released one photo-insensitive variety namely Suphala in 2006 which is suited for year round cultivation. It is a high yielding (15.93 t ha^{-1}) variety with a duration of 120-140 days (KAU, 2007). Hence an investigation was undertaken to study the performance of this variety during off- season as influenced by date of planting and nutrient management.

The investigation was carried out at the Instructional Farm attached to College of Agriculture Vellayani during November 2013 to May 2014. The soil was sandy clay loam and acidic with a pH of 4.62. It was high in organic carbon (1.15 %) and available P (35.2 kg ha^{-1}) and low in available N (213.26 kg ha^{-1}) and K (102 kg ha^{-1}) contents. The treatments consisted of four dates of planting (November 15, December 1, December 15 and January 1) and three nutrient management practices (Recommended dose - 60:60:100 kg NPK ha^{-1} through fertilizers; recommended dose through organic manures - 6 t FYM + 3 t coir pith compost + 3 t wood ash ha^{-1} + PGPR mix1 and modified nutrient dose - 60:30:120 kg NPK ha^{-1} through fertilizers). The experiment was laid out in split plot design with dates of planting in main plots and nutrient management practices in sub plots with four replications. A uniform dose of FYM @ 10 t ha^{-1} and neem cake @ 1 t ha^{-1} was applied to all plots during land preparation.

The required quantities of FYM and coir pith compost as per the treatments were applied as basal dose to organic plots and appropriate quantity of wood ash as per the treatment was applied six weeks after planting and incorporated into soil. Half of the calculated quantities of urea and muriate of potash and full quantity of rock phosphate were applied to the inorganic plots as basal dose and half of urea and muriate of potash were top dressed six weeks after planting and mixed with soil. The biofertilizer, PGPR mix 1 was applied @ 30 kg ha^{-1}. Chinese potato cuttings were treated with 2 % slurry of PGPR mix I before planting and the remaining quantity of the biofertilizer was applied in the root zone mixed with FYM in the ratio 1:25 after planting the treated cuttings. Growth characters like plant height and number of branches and leaves per plant were recorded at monthly intervals. The leaf area was worked out by adopting the non-destructive method developed by Ravi et al. (2011) and leaf area index was calculated as suggested by Watson (1947). Dry matter production was recorded at harvest. The sample plants uprooted were separated into leaves, stem and tubers. Fresh weight of each part was recorded and sub samples were taken for estimating the dry weight. The sub samples were dried in a hot air oven at 70± 5^{o}C to constant dry weight. Then the dry weight of each part was worked out and total dry matter production was computed in t ha^{-1}.

In general, plant height increased from 1 month after planting (MAP) to 4 MAP (harvest stage) and number of branches and leaves per plant increased from 1 MAP upto

Table 1. Effect of date of planting and nutrient management on the growth characters of Chinese potato

Treatment	Plant height (cm)				No. of branches per plant				Leaf area index				No. of leaves			
	1 MAP	2 MAP	3 MAP	4 MAP	1 MAP	2 MAP	3 MAP	4 MAP	1 MAP	2 MAP	3 MAP	4 MAP	1 MAP	2 MAP	3 MAP	4 MAP
Date of planting																
Nov-15	11.78	21.88	25.74	32.77	8.01	9.95	10.86	9.23	1.32	2.83	2.01	1.57	47.5	92.01	98.53	75.45
Dec-01	12.4	15.58	21.84	27.81	8.14	9.45	10.65	9.11	1.17	2.1	1.86	1.1	51.56	64.67	77.48	62.95
Dec-15	9.95	15.03	21.59	25.03	6.39	8.25	9.73	9.03	1.03	1.46	1.34	0.96	31.6	53.78	67.72	45.89
Jan-01	9.84	15.64	20.62	24.51	5.89	8.06	9.45	8.48	0.93	1.3	1.08	0.86	31.61	50.56	61.23	43.11
CD(0.05)	1.28	1.717	2.198	3.18	0.62	1.054	0.741	NS	0.026	0.187	0.111	0.099	3.952	9.364	8.853	9.886
Nutrient management																
RD-fertilizers	10.62	16.46	21.89	25.21	7.12	8.79	9.84	8.82	1.09	1.81	1.5	1.05	40.06	62.21	74.87	55.98
RD-organic manures	10.7	15.64	20.64	26.02	6.79	8.46	9.65	8.44	0.95	1.64	1.37	0.96	38.08	59.84	69.08	49.98
Modified dose - fertilizers	11.65	19	24.79	31.35	7.41	9.52	11.02	9.63	1.29	2.31	1.85	1.36	43.57	73.72	84.77	64.59
CD(0.05)	0.63	1.188	1.22	1.207	0.393	0.352	0.38	0.637	0.027	0.08	0.07	0.053	3.244	3.205	2.88	1.865

MAP- Months after planting RD- Recommended dose NS- Not significant

3 MAP and declined at harvest (Table 1). The leaf area index increased upto 2 MAP and thereafter it decreased towards harvest. The results revealed that the different dates of planting significantly influenced the growth characters like plant height, number of branches and leaves per plant and leaf area index at all stages of crop growth (Table1). Planting on November 15 recorded the tallest plants at all growth stages except 1 MAP. At 1 MAP, December 1 planting produced taller plants than November 15 planting. Early planting on November 15 or December 1 produced significantly more number of branches than late planting on December 15 or January 1 at all growth stages except at harvest (4 MAP) when the effect was not significant. The highest number of leaves per plant was recorded by November 15 planting followed by December 1 planting at all growth stages except 1 MAP. At 1 MAP, December 1 planting recorded higher number of leaves compared to November 15 planting. However, a decreasing trend in leaf area index at all growth stages was observed with delay in planting. Planting on November 15 recorded the highest leaf area index and planting on January1 recorded the lowest index. Total dry matter production presented in Table 2 also showed a declining trend with delay in planting, the highest quantity of dry matter being produced by November 15 planting and the lowest by January 1 planting. The favourable effect of November 15 planting on growth characters was reflected in the dry matter production. The highest dry matter production in sweet potato due to November 30 planting was reported by Mukhopadhyay et al. (1991).

Nutrient management significantly influenced the growth characters at all

growth stages (Table 1). Application of modified nutrient dose of 60:30:120 kg NPK ha^{-1} through fertilizers combined with a uniform basal dose of FYM @ 10 t ha^{-1} (integrated nutrient management) produced superior values of growth characters like plant height, number of branches and leaves per plant and leaf area index at all growth stages. There was no significant variation in plant height and number of branches per plant when the recommended dose of nutrients (60:60:100 kg NPK ha^{-1}) was applied through fertilizers or organic manures along with the basal dose of FYM @ 10 t ha^{-1}. Similar trend was observed in leaf number during initial stages of growth. But recommended dose through fertilizers recorded higher number of leaves per plant than the same dose through organic manures during later stages of crop growth. However, in the case of leaf area index, recommended dose through fertilizers was superior to recommended dose through organic manures at all growth stages. Modified nutrient dose through fertilizers recorded the highest dry matter production followed by recommended dose through fertilizers and the lowest by recommended dose through organic manures (Table 2). The effect of nutrient management practices on total dry matter production is indicative of its cumulative favourable effect on growth characters.The necessity of application of higher K dose for higher dry matter production in Chinese potato has been reported by Geetha (1983).The sufficiency of a lower dose of P for Chinese potato has been reported by Geetha (1983) and Archana and Swadija (2000).

The results indicated that planting on November 15 applying modified nutrient dose of 60:30:120 kg NPK ha^{-1} through fertilizers along with FYM @ 10 t ha^{-1} and neem cake @ 1 t $ha^{-1}$is ideal for better growth and higher dry matter production of Chinese potato var. Suphala during the off- season.

Table 2. Effect of date of planting and nutrient management on total dry matter production

Treatments	Total dry matter production (t ha^{-1})
Date of planting	
Nov-15	5.73
Dec-01	5.18
Dec-15	4.26
Jan-01	3.66
CD(0.05)	0.175
Nutrient management	
RD-fertilizers	4.47
RD-organic manures	4.06
Modified dose -fertilizers	5.59
CD(0.05)	0.173

RD- Recommended dose NS- Not significant

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College of Agriculture, Vellayani
Thiruvananthapuram 695 522, Kerala, India
Corresponding author: Anju.V.S; e-mail: anjusnehalatha@gmail.com

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V.S. Anju
O.K. Swadija
Atul Jayapal