

Effect of sowing dates and reproductive pruning on growth parameters of Yam Bean (*Pachyrrhizus erosus* L.)

ABSTRACT:

Yam bean is one of the hidden treasures of leguminous tuber crops. It can serve major key nutrients that the larger part of the global population and their livestock have access to. These Plants serve a portion of food which is cheaper, affordable and readily available compared to other sources of food. Unfortunately in India, this crop is ignored and under-utilized [10]. Yam bean has the potential to combat the challenges of food and nutritional insecurity and widen the food and feed products base for both human and livestock consumption if the crop is commercialized [6]. Sowing time of yam bean highly affect the growth and yield of yam bean tuber, sowing is done mostly on onset of monsoon. Late sowing affect germination rate, number of leaves and delaying in flowering. Therefore, an experiment on “Study the effect of Sowing dates on growth parameters of Yam bean (*Pachyrrhizus erosus* L.)” was conducted at Department of Vegetable Science, College of Horticulture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during *Kharif* season of year 2023-24. Two factors were studied during the investigation using factorial randomized block design ($p = .05$) viz. sowing dates (D) *i.e.*, D₁-1st week of June, D₂-3rd week of June, D₃ -1st week of July, D₄ -3rd week of July. Result showed that the highest plant height 120 days after sowing was observed in D₁P₂ (202.17 cm) which was at par with the D₁P₃ (200.40 cm) whereas, the lowest was recorded in D₄P₃ (89.00 cm) and average number of leaves was highest in the D₂P₁ (107.17), whereas the lowest average was found in the D₃P₃ (71.20) leaves per plant.

INTRODUCTION

Yam bean cultivation is now becoming more popular among the farmers of the Konkan region due to its nutritional properties. Yam bean can withstand high rainy conditions due to their hardy nature. The lateritic soils of the Konkan region are generally sandy clay loam in texture with pH 5.0-6.0, highly base leached and sesquioxide soils favour the production of yam bean. Successful yam bean production in many regions depends upon selecting suitable time for sowing by the specific environment. Sowing time of yam bean highly affect the growth and yield of yam bean tuber, sowing is done mostly on onset of monsoon. Late sowing affect germination rate, number of leaves and delaying in flowering. Further, it is highly nutritious therefore, increasing demand from consumers. Thus, there is good scope for increasing the production and productivity of yam bean in the Konkan region [13] The study's results could directly benefit farmers and agricultural playmakers in similar agro-climatic zones [8].

MATERIALS AND METHODS

Site and Weather

The current study was conducted during the *Kharif* season of 2023-24 at Research Farm, Department of

Vegetable Science, College of Horticulture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Which is located at 280 m above MSL with 17°45'N Latitude and 73°12' E Latitude. The area has a high rainy condition with hot and humid climate. The south-west monsoon occurs from June to September contributing to around 80% of total rainfall. The meteorological data (Table. 1) recorded during the growth and yield period of the crop. The average maximum and minimum weekly temperature was between 17.00°C to 20.95°C and overall 3978mm of rainfall was recorded throughout the crop (June- December).

Experimental Details

The current study was undertaken to study the effect of sowing dates and reproductive pruning on growth parameters of Yam Bean (*Pachyrrhizus erosus* L). Growth parameters viz. plant height and number of leaves which ultimately express the biological yield of crop. The yield of any crop is dependent on the morphological development of the plant. While studying the growth parameters of tuber crops, it was observed that there is no effect on germination while plant height and number of leaves exhibited some variations among the different sowing dates under study.

The experimental study was laid out in a factorial randomized block design with three replications. Two factors were studied during the investigation viz. a) sowing dates (D) D₁-1st week of June, D₂-3rd week of June, D₃ -1st week of July, D₄ -3rd week of July and b) Interval of reproductive pruning (P) P₁ – Weekly, P₂ – Fortnightly, P₃ – No pruning Individual plot size was 3 m x 3 m. The spacing between the ridges was 60cm and seed to seed distance was 20 cm respectively. In between two replications the spacing 1m was added to maintain plants and avoid the nutrients uptake from the other block. The area of experimental field was 21.2m X 21m. Single seed was sown on the ridge at the spot of fertilizer application which were made as per the desired spacing at the depth of 2-3 cm and seeds are sown four different planting dates i.e. 1st week of June, 3rd week of June, 1st week of July and 3rd week of July respectively. Six to seven weeks after sowing yam bean starts flowering. Removal of flower buds is done at intervals of weekly and fortnightly. Removal of flower bud is a practice for better production of yam bean tubers. The flower buds were removed at the purple colour and particularly opened stage.

Observations Recorded

Plant height was measured from the ground level to the tip of the growing point at 30, 60, 90 and 120 days (at the time of harvesting) and total numbers of leaves per plant were counted each of the five selected plants from each replication of treatment combination and after computing the mean, it was recorded as a leaves per plant at 30, 60, 90 and 120 days (at the time of harvesting).

Statistical Analysis

The data collected on different yield-related attributes were analysed using analysis of variance (ANOVA) in factorial randomized block design using the method suggested by Panse and Sukhatme [7]. The standard error (S.E.) of means was worked and a critical difference (CD) at 5% i.e. ($p=0.05$) was also worked out whenever the result was significant.

RESULTS AND DISCUSSION

Plant height (cm)

The data presented in Table 2 demonstrated that the sowing dates on plant height showed significant effect and the highest plant height was achieved in D₁ (199.35 cm) i. e. 1st week of June and the lowest plant height was recorded in D₄ (90.63 cm) 3rd week of July. Plant height increased with successive sowing until early June and then decreased with further delays. June provided more favourable temperatures and moisture levels for

germination, growth and establishment of plant. These results were consistent with those recorded by Kang[3] in soybean, Ghobadi and Ghobadi [2] in coriander and Singh and Kumar [9] in *Kharif* mash.

However, for reproductive pruning plant height was significantly affected, P₂ (145.37 cm) recorded highest plant height, however P₃ (142.63 cm) recorded the lowest height. The plant height was increased with regular pruning of flowers, likely due to the plant redirects energy from reproductive parts to vegetative growth. This resulted in taller plants, as more resources were allocated to height rather than reproductive growth. These results were in conformity with Gao[1] in *Helianthus tuberosus* L and Wangolo[12] in spider plant. For interaction effect between sowing dates and reproductive pruning was found statistically significant. However, the highest plant height was observed in D₁P₂ (202.17 cm) which was at par with the D₁P₃ (200.40 cm) whereas, the lowest was recorded in D₄P₃ (89.00 cm). When yam bean plants were sown in June and subjected for fortnightly reproductive pruning, they got benefit from both for enhanced vegetative growth. June sowing may develop a stronger stem structure in plants and allowing them to support height without lodging. These results are in conformity with the results recorded by Kang [3] in soybean. While pruning may reduce immediate pod production, it can enhance the overall health and vigour of the plant, potentially leading to better yield in subsequent growth phases.

Number of leaves

Data presented in table 3 demonstrated that the various sowing dates significantly affect the number of leaves per plant maximum number of leaves were recorded in D₂ (104.03). Whereas, the minimum number of leaves was found in D₃ i.e. 1st week of July (72.83). The probable reason for this might be due to the favourable temperature and suitable soil moisture during early sowing as compared to low temperature and higher soil moisture during late planting of yam bean. The above results agreed with the result found by Vishwas[11] in potato and Nisha Kumari [5] in sweet potato. At 120 DAS, the number of leaves varied significantly among treatments of reproductive pruning. The reproductive pruning at weekly interval i.e. P₁ (89.16) recorded the maximum number of leaves which was at par with fortnightly reproductive pruning P₂ (88.13) and minimum number of leaves were recorded in P₃ (85.85) i. e. no pruning. The number of leaves increased with regular pruning of flowers. This was likely due to the plant redirecting energy from reproductive parts to vegetative growth. These results are in conformity with Gao [1] in *Helianthus tuberosus* L. and Lawrence [4] in pigeon pea. Number of leaves varied significantly among treatment combinations of sowing dates and reproductive pruning, the average number of leaves was highest in the D₂P₁ (107.17), whereas the lowest average was found in the D₃P₃ (71.20) leaves per plant. The combined effects of sowing dates and reproductive pruning leads to increased number of leaves in yam bean. Early sowing benefited from favourable temperatures and optimal soil moisture, while late sowing experienced lower temperatures and higher moisture levels. This aligned with findings by Vishwas[11] in potato. Additionally regular flowers pruning redirected the plant energy towards vegetative growth. Resulting in taller plants due to resource allocation for height rather than reproductive development. These results are in conformity with the Gao[1] in *Helianthus tuberosus* L.

CONCLUSION

Among the different treatments it was concluded that for better growth characters of yam bean, it should be sowed in D₁P₂ (1st week of June with fortnightly reproductive pruning) and maximum numbers of leaves were recorded in D₂P₁ (3rd week of June with weekly reproductive pruning) respectively under Konkan agroclimatic conditions.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

**Table 1. Weekly meteorological data of the year 2023((From 04.06.2023 to 09.12.2023) Dr. Balasaheb Sawant
Konkan Krishi Vidyapeeth Dapoli, Maharashtra, India**

Period	MW	Tmax (oC)	Tmin (oC)	RH-I (%)	RH-II (%)	Wind speed (Kmph)	Rain (mm)	RD day
04.06 - 10.06	23	34.3	24.1	81	60	6.6	1.2	0
11.06 - 17.06	24	33.2	25.0	84	67	9.6	52.8	4
18.06 - 24.06	25	31.9	24.6	85	67	6.6	27.2	1
25.06 - 01.07	26	28.2	22.6	96	93	7.0	596.6	7
02.07 - 08.07	27	27.9	23.1	97	93	6.5	632.8	7
09.07 - 15.07	28	28.8	23.5	93	89	6.7	159.2	7
16.07 - 22.07	29	28.0	23.1	94	92	10.7	511.6	7
23.07 - 29.07	30	26.9	23.0	97	93	10.2	618.8	7
30.07 - 05.08	31	28.1	24.1	95	90	8.8	181.6	6
06.08 - 12.08	32	29.2	23.7	92	83	5.6	31.6	5
13.08 - 19.08	33	28.9	23.6	91	85	6.1	54.0	6
20.08 - 26.08	34	28.7	22.6	94	87	5.0	124.8	7
27.08 - 02.09	35	29.5	22.5	94	82	3.3	121.4	4
03.09 - 09.09	36	28.8	22.3	93	85	3.7	353.4	2
10.09 - 16.09	37	29.3	22.9	92	79	4.1	110.0	5
17.09 - 23.09	38	29.3	23.1	95	85	5.7	158.8	6
24.09 - 30.09	39	29.5	22.4	93	87	2.8	141.8	5
01.10 - 07.10	40	28.6	21.7	95	82	3.2	126.2	2
08.10 - 14.10	41	32.4	22.3	94	72	2.7	0.0	0
15.10 - 21.10	42	33.9	22.3	92	73	2.4	0.0	0
22.10 – 28.10	43	34.1	19.2	89	54	2.5	0.0	0
29.10 – 04.11	44	33.9	17.9	90	48	2.2	0.0	0
05.11 – 11.11	45	33.3	20.5	88	59	2.8	0.0	0
12.11 – 18.11	46	33.9	17.9	91	51	2.2	0.0	0
19.11 – 25.11	47	34.1	17.7	91	46	2.5	0.0	0
26.11 – 02.12	48	32.1	18.4	94	53	3.1	1.4	0
03.12–09.12	49	32.6	16.6	94	56	2.8	0.0	0

Table 2: Effect of sowing dates and reproductive pruning on plant height (cm) of yam bean.

Treatments	Plant height (cm)							
	30 DAS				60 DAS			
	Reproductive pruning (P)				Reproductive pruning (P)			
Planting date (D)	P1	P2	P3	Mean	P1	P2	P3	Mean
D1	6.93	6.42	7.05	6.80	42.73	47.83	45.00	45.18
D2	7.76	8.03	8.43	8.07	43.73	40.24	31.93	38.63
D3	7.30	6.49	7.03	6.93	33.49	36.09	31.29	33.62
D4	7.66	6.55	6.11	6.77	27.83	30.27	25.97	28.02
Mean	7.41	6.87	7.15	7.14	36.94	38.60	33.54	36.36
	Result	S.E m ±	CD @5%		Result	S.E m ±	CD @5%	
D	SIG	0.13	0.38		SIG	1.16	3.41	
P	SIG	0.11	0.33		SIG	1.00	2.95	
DxP	SIG	0.22	0.66		SIG	2.01	5.90	
Treatments	90 DAS				120 DAS			
	Reproductive pruning (P)				Reproductive pruning (P)			
	Planting date (D)	P1	P2	P3	Mean	P1	P2	P3
D1	107.83	120.30	106.00	111.37	195.50	202.17	200.40	199.35
D2	103.84	99.42	92.61	98.62	192.32	190.64	184.87	189.27
D3	83.50	88.83	86.37	86.23	93.97	97.77	96.00	95.91
D4	78.50	75.77	73.93	76.06	92.10	90.80	89.00	90.63
Mean	93.41	96.08	96.09	95.19	143.47	145.37	142.63	143.82
	Result	S.E m ±	CD @5%		Result	S.E m ±	CD @5%	
D	SIG	0.91	2.66		SIG	0.56	1.64	
P	SIG	0.79	2.31		SIG	0.49	1.43	
D x P	SIG	1.58	4.61		SIG	0.97	2.83	

Sowing dates:	D ₁ - Sowing 1 st week of June	D ₂ - Sowing 3 rd week of June	D ₃ – Sowing 1 st week of July	D ₄ – Sowing 3 rd week of July
Reproductive pruning:	P ₁ -Weekly pruning	P ₂ - Fortnightly pruning	P ₃ - No pruning	

Table 3: Effect of sowing dates and reproductive pruning on number of leaves per plant in yam bean.

Treatments	Number of leaves per plant							
	30 DAS				60 DAS			
	Reproductive pruning (P)				Reproductive pruning (P)			
Planting date (D)	P1	P2	P3	Mean	P1	P2	P3	Mean
D1	8.73	8.13	8.47	8.44	38.13	38.40	37.60	38.04
D2	8.72	10.50	9.07	9.43	44.93	43.13	46.74	44.93
D3	7.20	7.40	7.00	7.20	29.10	32.87	31.17	31.04
D4	6.80	7.27	7.13	7.06	27.27	30.87	25.00	27.71
Mean	7.86	8.32	7.91	8.03	34.85	36.31	35.12	35.42
	Result	S.E m ±	CD @5%		Result	S.E m ±	CD @5%	
D	SIG	0.20	0.59		SIG	0.34	0.99	
P	NS	0.18	-		SIG	0.29	0.86	
D x P	NS	0.35	-		SIG	0.59	1.72	
Treatments	Number of leaves per plant							
	90 DAS				120 DAS			
	Reproductive pruning (P)				Reproductive pruning (P)			
Planting date (D)	P1	P2	P3	Mean	P1	P2	P3	Mean
D1	75.87	78.80	75.07	76.65	101.93	97.33	97.67	98.97
D2	76.70	79.33	82.97	79.66	107.17	103.80	101.93	104.03
D3	47.53	50.70	53.37	50.53	72.77	74.53	71.20	72.83
D4	40.00	44.33	41.67	42.00	74.80	76.87	72.60	74.75
Mean	60.02	63.29	63.26	62.19	89.16	88.13	85.85	87.71
	Result	S.E m ±	CD @5%		Result	S.E m ±	CD @5%	
D	SIG	0.59	1.7446		SIG	0.51	1.52	
P	SIG	0.52	1.5108		SIG	0.45	1.32	
D x P	SIG	1.03	3.022		SIG	0.89	2.63	



Fig.1 General View of Experimental Plot

REFERENCES

1. Gao K, Zhang Z, Zhu T and Coulter J A. The influence of flower removal on tuber yield and biomass characteristics of *Helianthus tuberosus* L. in a semi- arid area. *Industrial Crops and Products*, 2020;**150**(2): 15-20.
2. Ghobadi M E and Ghobadi M. The effect of sowing dates and densities on yield and yield components of coriander (*Coriander sativum* L.). *International J. Agricultural and Biosystems Engineering*, 2010;**4**(10): 725728.
3. Kang Y K, Kim H T, Cho N C and Kim Y C. Effect of planting date and plant density on yield and quality of soybean forage in Jeru. *Korean J. crop Science*, 2001;**46**(2): 95-99.
4. Lawrence K, Sharma M B and Longchar A. Effect of planting dates on the performance of promising pigeon genotypes under NEHZ. *International J. Economic Plants*, 2020;**7**(1): 6-8.
5. Nisha Kumari Meena, Rathore R S and Mithlesh Kumari Meena. Effect of planting dates and plant spacing on growth and yield attributes of sweet potato (*Ipomoea batatas* Lam.) cv.Co-3-4. *International J. Current Microbiology Applied Science*, 2020; **9**(4): 2602- 2628.
6. Oagile O, Davey M R and Alderson P G. An under-utilized legume with potential as a tuber and pulse crop. *J. Crop Improvement*, 2007;**20**(1-2): 53-71.
7. Panse V G and Sukhatme P V. Statistical methods for Agriculture workers. ICAR, New Delhi 1995.
8. Shravika L, Sreenivas G, Madhavi A and Rao A M. Influence of planting date and cultivars on fruit yield and economics of *kharif* tomato. *Environment and Ecology*, 2021;**39**(4A): 1199-1202.
9. Singh M and Kumar R. Effect of date of sowing and seed rate on the growth and yield of *kharif* mash (*Vigna mungo* L.). *Agriculture Science Digest*, 2014;**34**(3): 211-214.
10. Thakur M, Puja Rattan, Reddy A H and Anju Pathania. Effect of different dates of sowing on growth, yield and quality of coriander (*Coriandrum sativum* L.). *International J. Biological Forum*, 2022;**14**(2a): 589597.
11. Vishwas U, Rathiya P S, Sinha K, Verma C P and Gupta A. Response of different date of planting on growth, yield and economics of potato (*Solanum tuberosum* L.) genotypes under Northern hill region of Chhattisgarh. *J. Pharmacognosy and Phytochemistry*, 2020;**9**(3): 1203-1205.
12. Wangolo E E, Onyango C M, Gachene C K & Mong'are P N. Effects of shoot tip and flower removal on growth and yield of spider plant (*Cleome gynandra* L.) in Kenya. *American J. of Experimental Agriculture*, 2015;**8**(6): 367-376.
13. Yesaware P S. Evaluation of nutritional quality of tuber crops grown in Konkan region. M. Sc. (Agri.) thesis studied to Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra 2014.