Study the effect of planting dates and reproductive pruning on yield attributes of Yam bean (*Pachyrrhizus erosus* L.)

Abstract

An experiment on "Study the effect of planting dates and reproductive pruning on yield attributes 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 year 2023-24. Two factors were studied during the investigation using factorial randomized block design (p= .05) viz. Planting dates (D) *i.e.*, D_1-1st week of June, D_2-3rd week of June, D_3 -1st week of July, D_4 -3rd week of July and Interval of reproductive pruning (P) *i.e.*, P_1 – Weekly, P_2 – Fortnightly, P_3 – No pruning. The results showed that weekly reproductive pruning (P_1) with planting date 3rd week of June (D_2) gave best effect on yield per plant (642.03 g), average weight of tuber (407.70 g),yield per hectare (12.90 t ha^{-1}) and length and diameter of tuber (21.50 cm and 17.53 cm) respectively.

Keywords: Yam bean, planting dates, reproductive pruning, yield

1.Introduction

Yam Bean (Pachyrrhizus spp.) is one of the multifunctional, underutilized minor tuber crops belongs to the family Leguminosae, under the subfamily Papillionaceae. There are five species under the genera Pachyrrhizus viz. *P. erosus*, *P. tuberosus* and *P. ahipa* are cultivated species and *P. ferrugineus*, *P. panamensis* are wild species. Among this *P. erosus* is mostly cultivated all over the world. Yam beans have refreshing, crispy ice-white, fruit-flavored tuber which can eaten raw or as cooked in various sweet dishes and in numerous savory

dishes worldwide. Tubers have very low-calories as well as high-quality dietary fiber (Oligofructose insulin) and antioxidants and some amount of minerals and vitamins. Yam bean tubers are also rich in vitamin C which is a powerful water-soluble antioxidant that helps the body scavenge harmful free radicals, thereby offering protection from cancers, inflammation, viral cough and cold. It contains a healthy amount of potassium which is responsible for keeping our heart in good shape [2]. Yam bean contributes to ensuring food security by providing food and feeds products, enrichment of other foods that are deficient in major nutrients with beneficial phytochemicals and bioactive compounds that reduce the risk of diseases. Yam bean cultivation is now becoming more popular among the farmers of the Konkan region due its nutritional properties. Yam bean can withstand in 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 times for sowing by the specific environment. 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 [5]. Yam bean, being an underutilized but nutritionally rich crop, has significant potential for enhancing food security, especially in region like the Konkan. The study's results could directly benefit farmers and agricultural playmakers in similar agro-climatic zones.

2. Materials and methods

The field trial was conducted at field of College of Horticulture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist- Ratnagiri (M.S) during Kharif season of the year 2023- 2024. Experiment was carried out in Factorial Randomized Block Design with three replications. Two factors were studied during the investigation viz. a) Planting dates (D) D_1-1st week of June, D_2 -3rd week of June, D_3 -1st week of July, D_4 -3rd week of July and b) Interval of reproductive pruning (P) P_1 – Weekly, P_2 – Fortnightly, P_3 – 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 spacing 1m was added to maintain plants and avoid the nutrients uptake from the other block. 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. on 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, fortnightly and no pruning. 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. The harvesting of the tubers started 120 days after planting. Yield per plant, average tuber weight, yield per hectare, length and diameter of tuber were observed as parameters. The data obtained in the present investigation were statistically analysed by the method suggested by Panse and Sukhatme [16]. The standard error (S.E.) of means was worked and a critical difference (CD) at 5% was also worked out whenever the result was significant.

3. Result and discussion

3.1 Yield per plant (g)

In present investigation, the combined effect of planting date and reproductive pruning was significant on tuber yield per plant (g). The highest yield was recorded in D_2P_2 (642.03 g), which was at per with the treatment D_2P_1 (607.83 g), the lowest yield per plant was recorded in D_4P_3 (250.13 g). The interaction effect of planting dates and interval of reproductive pruning may give more yield per plant due to the June often coincides with favourable weather conditions, including adequate rainfall and sunlight. The similar trend observed by Karhale et al. [12] in kharif sorghum, Bobade et al. [6] in kharif green gram, Lowrence et al. [13] in pigeon pea and Nisha Kumari et al. [15] in sweet potato. Pruning practice could increase the tuber yield of plant due to plants shifts energy from reproductive parts to vegetative parts (leaf and tuber). The similar findings were reported by the Mardhiana et al. [14] in cucumber and Gao, et al. [9] in *Helianthus tuberosus* L

3.2 Average tuber weight (g)

The combined effect of planting date and reproductive pruning was significant on average tuber weight (g). The highest average tuber weight was found to be in treatment D_2P_1 (407.70 g) which was at par with D_1P_2 (387.17), D_3P_1 (386.67 g), D_2P_2 (382.83 g) and D_1P_1 (331.36 g). The lowest were recorded in D_4P_3 (183.13 g). This may due to the Pruning practice could increase the tuber yield of plant due to plants shifts energy from reproductive parts to vegetative parts and the June often coincides with favourable weather conditions, including adequate rainfall and sunlight, which are essential for healthy plant growth and tuber development as compared to July planting.

3.3 Yield per hectare (tonnes)

The interaction effect of planting dates and interval of reproductive pruning on tuber yield per hectare (t ha^{-1}) was found to be significant. The highest yield was recorded in D_2P_1 (12.90 t ha^{-1}) which was at par with D_2P_2 (10.41 t ha^{-1}). However, the lowest yield was obtained in D_4P_3 (2.74 t ha^{-1}). The planting dates 1st week of June and 3rd week of June give maximum yield due to better growth and thrive well in heavy rain as compared to 1st week of July and 3rd week of July where more mortality of plants was observed. Similar findings were reported by the Kang et al. [11] in soybean, Canavar and Kaynak [7] in peanut, Bashir et al. [3] in rice, Karhale et al. [12] in kharif sorghum and Bobade et al. [6] in kharif green gram. While the Pruning practices increase the yield per hectare. Similar findings were reported by Belford et al. [4] in yam bean, Adjahossou, [1] in yam bean, Chakraborty et al. [8] in mungbean and Gibregwergis et al. [10] in potato.

3.4 Tuber length (cm)

The combined effect of planting dates and interval of reproductive pruning on tuber length was found to be significant. The highest tuber length was found in D_2P_1 (21.50 cm) which at par with D_2P_2 (20.77 cm). However, the lowest tuber length was recorded in D_4P_1 (16.17 cm).

This might be due to the planting at the right time could have helped to avoid stress from extreme weather conditions and allowed plants to allocate more energy to tuber growth. Regular pruning also encouraged bushier growth and increased leaf area, enhancing photosynthesis and ultimately leading to larger tubers.

3.5 Tuber diameter (cm)

The interaction effect of planting dates and interval of reproductive pruning on tuber diameter was found significant. The highest tuber diameter was reported in D_2P_2 (17.53 cm) which at par with D_2P_1 (16.38 cm). However, the lowest tuber diameter was reported in D_4P_3 (4.57 cm). This may due to the optimal planting dates and strategic reproductive pruning help to maximize resource allocation and growth conditions for yam beans. This approach allows the plants to thrive and produce larger and healthier tubers.

4. Conclusion

Among the different treatments it was concluded that for better yield and yield attributing characters of yam bean, it should be planted in 3rd week of June with weekly reproductive pruning i.e. D_2P_1. under Konkan agro-climatic conditions.

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1. Effect of planting dates and interval of reproductive pruning and their interaction on yield per plant (g) in yam bean.

Treatments	Yield per plant (g)			
	Interval of reproductive pruning (P)			
Planting dates (D)	P_1	P_2	P_3	Mean
D_1	490.73	486.10	453.00	**476.61**
D_2	607.83	642.03	393.82	**547.89**
D_3	475.67	406.67	286.87	**389.73**
D_4	403.72	296.17	250.13	**316.67**
Mean	**494.48**	**457.74**	**345.95**	**432.72**
	Result	S.E m ±	CD at 5%	
D	**SIG**	20.65	60.57	
P	**SIG**	17.89	52.46	
DxP	**SIG**	35.77	104.90	

Planting dates	Reproductive pruning
D_1- 1st week of June D_3- 1st week of July D_2- 3rd week of June D_4- 3rd week of July	P_1-Weekly pruning P_2- Fortnightly pruning , P_3- No pruning

2. Effect of planting dates and interval of reproductive pruning and their interaction on average tuber weight (g) of yam bean.

Treatments	Average tuber wt. (g)			
	Interval of reproductive pruning (P)			
Planting dates (D)	P_1	P_2	P_3	Mean
D_1	331.16	387.17	194.50	**304.20**
D_2	407.70	382.83	215.37	**335.30**
D_3	386.67	293.33	189.33	**289.77**
D_4	210.00	140.00	133.33	**161.11**
Mean	**333.88**	**300.83**	**183.13**	**272.61**
	Result	S.E m ±	CD at 5%	
D	**SIG**	16.59	48.67	
P	**SIG**	14.37	42.15	
DxP	**SIG**	28.74	84.29	

Planting dates	Reproductive pruning
D_1- 1st week of June D_3- 1st week of July D_2- 3rd week of June D_4- 3rd week of July	P_1-Weekly pruning P_2- Fortnightly pruning , P_3- No pruning

3. Effect of planting dates and interval of reproductive pruning and their interaction on yield per hectare (ton) of yam bean.

Treatments	Yield per ha. (ton)			
	Interval of reproductive pruning (P)			
Planting dates (D)	P_1	P_2	P_3	Mean
D_1	8.45	9.31	8.40	**8.72**
D_2	12.90	10.41	7.18	**10.16**
D_3	10.27	7.49	4.12	**7.29**
D_4	4.77	6.14	2.74	**4.55**
Mean	**9.09**	**8.33**	**5.61**	**7.67**
	Result	S.E m ±	CD at 5%	
D	**SIG**	0.51	1.49	
P	**SIG**	0.44	1.29	
DxP	**NS**	0.88	2.58	

Planting dates	Reproductive pruning
D_1- 1st week of June D_3- 1st week of July D_2- 3rd week of June D_4- 3rd week of July	P_1-Weekly pruning P_2- Fortnightly pruning , P_3- No pruning

4. Effect of planting dates and interval of reproductive pruning and their interaction on length (cm) of yam bean.

Treatments	Length (cm)			
	Interval of reproductive pruning (P)			
Planting dates (D)	P_1	P_2	P_3	Mean
D_1	19.17	17.90	17.40	**18.15**
D_2	21.50	20.77	19.73	**20.66**
D_3	18.43	16.30	17.07	**17.26**
D_4	16.13	18.40	16.17	**16.9**
Mean	**18.80**	**18.34**	**17.59**	**18.24**
	Result	S.E m ±	CD at 5%	
D	**SIG**	0.29	0.83	
P	**SIG**	0.25	0.72	
DxP	**SIG**	0.49	1.44	

Planting dates	Reproductive pruning
D_1- 1st week of June D_3- 1st week of July D_2- 3rd week of June D_4- 3rd week of July	P_1-Weekly pruning P_2- Fortnightly pruning , P_3- No pruning

5. Effect of planting dates and interval of reproductive pruning and their interaction on diameter (cm) of yam bean tuber.

Treatments	Diameter (cm)			
	Interval of reproductive pruning (P)			
Planting dates (D)	P_1	P_2	P_3	Mean
D_1	13.23	15.38	10.53	**13.04**
D_2	16.38	17.53	8.53	**14.14**
D_3	13.67	9.10	6.33	**9.70**
D_4	9.36	5.83	4.57	**6.58**
Mean	**13.16**	**11.96**	**7.49**	**10.87**
	Result	S.E m ±	CD at 5%	
D	**SIG**	0.32	0.92	
P	**SIG**	0.28	0.79	
DxP	**SIG**	0.55	1.59	

Planting dates	Reproductive pruning
D_1- 1st week of June D_3- 1st week of July D_2- 3rd week of June D_4- 3rd week of July	P_1-Weekly pruning P_2- Fortnightly pruning , P_3- No pruning

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	Tmin	RH-I	RH-II	Wind speed	Rain	RD	BSS	Epan
		(oC)	(oC)	(%)	(%)	(Kmph)	(mm)	day	(hrs.)	(mm)
04.06 - 10.06	23	34.3	24.1	81	60	6.6	1.2	0	10.2	5.9
11.06 - 17.06	24	33.2	25.0	84	67	9.6	52.8	4	7.6	4.9
18.06 - 24.06	25	31.9	24.6	85	67	6.6	27.2	1	7.2	4.9
25.06 - 01.07	26	28.2	22.6	96	93	7.0	596.6	7	0.2	2.0
02.07 - 08.07	27	27.9	23.1	97	93	6.5	632.8	7	0.0	2.1
09.07 - 15.07	28	28.8	23.5	93	89	6.7	159.2	7	1.7	2.8
16.07 - 22.07	29	28.0	23.1	94	92	10.7	511.6	7	0.9	2.5
23.07 - 29.07	30	26.9	23.0	97	93	10.2	618.8	7	0.0	2.1
30.07 - 05.08	31	28.1	24.1	95	90	8.8	181.6	6	0.1	3.1
06.08 - 12.08	32	29.2	23.7	92	83	5.6	31.6	5	2.6	3.4
13.08 - 19.08	33	28.9	23.6	91	85	6.1	54.0	6	4.7	3.3
20.08 - 26.08	34	28.7	22.6	94	87	5.0	124.8	7	3.2	3.0
27.08 - 02.09	35	29.5	22.5	94	82	3.3	121.4	4	5.2	2.8
03.09 - 09.09	36	28.8	22.3	93	85	3.7	353.4	2	2.8	3.6
10.09 - 16.09	37	29.3	22.9	92	79	4.1	110.0	5	4.1	2.7
17.09 - 23.09	38	29.3	23.1	95	85	5.7	158.8	6	3.8	2.8
24.09 - 30.09	39	29.5	22.4	93	87	2.8	141.8	5	1.5	2.8
01.10 - 07.10	40	28.6	21.7	95	82	3.2	126.2	2	3.9	2.6
08.10 - 14.10	41	32.4	22.3	94	72	2.7	0.0	0	8.3	3.8
15.10 - 21.10	42	33.9	22.3	92	73	2.4	0.0	0	6.4	4.1
22.10 – 28.10	43	34.1	19.2	89	54	2.5	0.0	0	7.6	3.9
29.10 – 04.11	44	33.9	17.9	90	48	2.2	0.0	0	7.8	4.0
05.11 – 11.11	45	33.3	20.5	88	59	2.8	0.0	0	5.8	4.0
12.11 – 18.11	46	33.9	17.9	91	51	2.2	0.0	0	8.1	4.0
19.11 – 25.11	47	34.1	17.7	91	46	2.5	0.0	0	8.0	4.0
26.11 – 02.12	48	32.1	18.4	94	53	3.1	1.4	0	6.5	3.7
03.12–09.12	49	32.6	16.6	94	56	2.8	0.0	0	7.2	3.7

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