Original Research Article

Effect of sowing dates and flower pruning on chemical properties and shelf life of Yam bean (*Pachyrrhizus erosus* L.) tubers

Abstract

Underutilized crops provide essential micro-nutrient and thus able to complement staple foods. The inhibitory effect of floral and fruit development may affect the tuber development. It is logical to assume that large amounts of nitrogen and other essential components are assimilated by the reproductive parts of plant, hence it is important to remove these reproductive parts as well as time of sowing also affect the shelf life and chemical properties of yam bean tubers which form the basis of an experiment on effect of sowing dates and flower pruning on chemical properties and shelf life of Yam bean (*Pachyrrhizus erosus* L.) tubers. An experiment was conducted at Department of Vegetable Science, College of Horticulture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during the year 2023. Twelve treatments and 3 replications in Factorial Randomized Block Design 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. Chemical analysis of the tubers was done to analyse the starch, fiber, dry matter, TSS and shelf life of the tubers from various treatments. Investigation revealed that among the various chemical parameters and shelf life the effect of interaction on starch, fiber, dry matter and shelf life was significant whereas it was non-significant on TSS. The highest starch content was recorded in D_3P_1 (6.81%). The fiber content was analysed highest in D_4P_3 (0.69 %). The highest dry matter content was analysed in D_1P_3 (24.59 %). The highest TSS was recorded in D_1P_1 (6.40 °B) and highest shelf life was recorded in D_1P_1 (36.56 days).

Keywords: Yam bean, shelf life, starch, TSS, fiber, dry matter, sowing dates and flower pruning

1. Introduction

Tuber crops are the third most important food crops in the world after cereals and legumes. These crops constitute an important food crop of mankind from time immemorial, sustaining people during days of famine or when there is a shortage of food. The tuber crops grown in the

world for their underground tubers, which a play vital role in subsistence farming and food security of the country [8].

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. 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 [5]. Yam bean tubers produce high quality protein rich starch which fulfills the alternative sources as food. Yam bean have scope in non-traditional areas and improves the rural economy. Different minerals and food components are present in yam bean tubers, comparable to other food legumes. Yam bean cultivation is now becoming more popular among the farmers of the Konkan region due its nutritional properties. The agro climatic condition of Konkan is one congenial for the cultivation of tuber crops. The crop has been introduced in the region in recent year and becoming popular slowly. Considering its nutritional quality and sustainability in the region it can be an alternative crop with food security, nutritional security as well as economic sustainability [9].

Yam bean (*Pachyrrhizus erosus* L.) is an important underground crop which is gaining importance day by day. Therefore scientific interventions and management of cultural practices like sowing dates and interval of flower pruning affecting chemical properties and shelf life of yam bean to boost its production is a significant effort. This is a good piece of work as the result would benefit the growers and producers.

2. Materials and methods

2.1 Experimental Details

The experiment on effect of sowing dates and flower pruning on chemical properties and shelf life of Yam bean (*Pachyrrhizus erosus* L.) tubers was conducted at field of College of Horticulture, Dapoli, Dist- Ratnagiri (M.S) during *Kharif* season of the year 2023. Which is located at 280 m above MSL with 17°45'N Latitude and 73°12' E Latitude. Experiment was carried out in Factorial Randomized Block Design with three replications. Two factors were studied during the investigation viz. a) Sowing dates (D) and b) Interval of flower pruning (P). The treatment details are given below:

Factor 'A'-Sowing dates (D).

Sr. No	Symbol	Sowing dates
1.	D_1	1st week of June
2.	D_2	3rd week of June
3.	D_3	1st week of July
4.	D_4	3rd week of July

Factor ‘B’- Interval of flower pruning (P).

Sr. No	Symbol	Interval of flower pruning
1.	P_1	Weekly
2.	P_2	Fortnightly
3.	P_3	No pruning

Individual plot size was 3 m x 3 m. 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 sowing dates i.e. 1st week of June, 3rd week of June, 1st week of July and 3rd week of July respectively. 6 to 7 week after sowing yam bean starts flowering. Pruning of flower buds is done at intervals of weekly, fortnightly and no pruning. Pruning 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.

2.2 Chemical Observations

The yam bean tubers harvested from each replication at maturity for determination of starch, fiber, dry matter, TSS and shelf life after 120 days of sowing. The average of 5 tubers from each treatment at 120 days after sowing (DAS) was taken for calculations. Fiber and starch content was estimated from fat free dry sample of yam bean tubers as per method suggested by Ranganna [7]. Dry matter content was obtained by oven dried of tubers at 80°C till constant weight was obtained. Shelf life of tuber was judged by weighing the tubers every alternate day until 15% loss in weight was found. The data obtained in the present investigation were statistically analysed by the method suggested by Panse and Sukhatme [6]. 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. Results and Discussion

3.1 Effect of sowing dates on the chemical properties and shelf life of yam bean tubers

In present investigation the data presented in Table 1 revealed significant effect of sowing dates on starch, dry matter, TSS and shelf life and found non-significant for fiber content. The highest starch was recorded in D_4 (6.25%) which were at par with the D_3 (6.06 %). However, the lowest starch content recorded in D_1 (5.02%). The highest fiber content was recorded in D_4 (0.57 %) and the lowest was recorded in D_1 (0.45 %). The highest dry matter content was recorded in D_1

(20.43%) which was at par with D_2 (20.06%). Whereas, the lowest dry matter content observed in D_4 (13.09%). The highest TSS content was recorded in D_1 (5.95 ^oB). However, the lowest was found in D_4 (4.91 ^oB). The highest shelf life was found in D_1 (33.11 days) which was significantly superior over rest of treatments. However, the lowest shelf life was recorded in D_4 (29.29 days).

.This results are confirmatry with the Gao *et al.* [4] in *Helianthus tuberosus* L. and Deena, *et al.* [3] in yam bean.

Table 1: Effect of sowing dates and flower pruning on starch, fiber, dry matter, TSS and shelf life of Yam bean tubers

Treatments	Starch %	Fiber %	Dry matter %	TSS (°B)	Shelf life (Days)
Sowing Dates (D)					
D_1 (1st week of June)	5.02	0.45	20.43	5.95	33.11
D_2 (3rd week of June)	5.90	0.50	20.06	5.53	31.33
D_3 (1st week of July)	6.06	0.53	14.46	5.44	31.33
D_4 (3rd week of July)	6.25	0.57	13.09	4.91	29.29
Result	SIG	NS	SIG	SIG	SIG
S.Em ±	±0.12	±0.02	±0.34	±0.14	±0.29
CD@ 5%	0.34	-	0.99	-	0.83
Treatments					
Flower pruning (P)					
P_1(Weekly pruning)	6.04	0.40	15.28	5.67	32
P_2 (Fortnightly pruning)	5.52	0.52	16.88	5.30	30.86
P_3 (No pruning)	5.87	0.60	18.87	5.40	30.90
Result	SIG	NS	SIG	NS	SIG
S.Em ±	±0.09	±0.08	±0.29	±0.12	±0.25
CD@ 5%	0.29	-	0.87	-	0.72

3.2 Effect of flower removal on chemical properties and shelf life of yam bean tubers

The effect of flower removal on tubers is presented in Table 1. The effect of flower removal was observed to be significant on starch, dry matter content and shelf life and non-significant for fiber and TSS. The highest starch content was recorded in P_1 (6.04 %) which was at par with P_3 (5.87%). Whereas, the lowest starch was reported in P_2 (5.52 %). The highest fiber content was recorded in P_3 (0.6 %) and lowest was recorded in P_1 (0.40 %). The highest dry matter content was found in P_3 (18.87%). Whereas, the lowest was found in P_1 (15.28%). The highest TSS was recorded in P_1 (5.67 ^oB). Whereas, the lowest TSS recorded in P_2 (5.30 ^oB).

The highest shelf life was observed in P_1 (32 days). However, the lowest was found in P_2 (30.86 days).

Similar findings reported by Belford et al. [2] in yam bean and Adjahossou [1] in yam bean.

3.3 Interaction effect of sowing dates and flower pruning on the chemical properties and shelf life of yam bean tubers

The interaction effect of different parameters of tubers is presented in Table 2. The interaction effect of sowing dates and flower pruning on the chemical properties and shelf life of yam bean tubers was found significant for starch, fiber, dry matter and TSS and found non-significant for TSS. The highest starch content was observed in D_3P_1 (6.81%) which was at par with D_4P_1 (6.55 %), D_2P_3 (6.35 %) and D_4P_2 (6.24 %). However, the lowest starch was recorded in D_1P_2 (4.66 %).

The highest fiber content in tuber was observed in D_4P_3 (0.69 %) which was at par with the D_4P_2 (0.68 %), D_3P_3 (0.59 %), D_3P_2 (0.56 %) and D_4P_1 (0.54 %). However, the lowest fiber content was observed in D_1P_1 (0.25 %).

The highest dry matter was recorded in D_1P_3 (24.50%). Whereas, the lowest dry matter content recorded in D_4P_1 (12.05%).

The highest TSS of tuber was recorded in D_1P_1 (6.40 ^{o}B). However, the lowest TSS was recorded in D_4P_3 (4.80 ^{o}B).

The highest shelf life was found in D_1P_1 (36.56 days). However the lowest was found in D_4P_2 (27.78 days).

Similar findings reported by Belford *et al.* [2] in yam bean, Adjahossou [1] in yam bean, Gao et al. [4] in *Helianthus tuberosus* L. and Deena, et al. [3] in yam bean.

4 Conclusions

From the present investigation it was concluded that the interaction between flower pruning and sowing date significantly influenced the starch, dry matter and shelf life of yam bean tubers. Optimal pruning combined with well-timed sowing enhanced nutrient profiles and overall tuber quality.

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.

Table 2: Interaction effect of sowing dates and flower removal on starch, fiber, dry matter, TSS and shelf life of Yam bean tubers

Treatments	Interaction effect of sowing dates and flower pruning				
	Starch	Fiber	Dry matter	TSS	Shelf life
T_1 (D_1P_1)	5.16	0.25	15.20	6.40	36.56
T_2 (D_1P_2)	4.66	0.38	21.51	5.73	34.00
T_3 (D_1P_3)	5.26	0.30	24.59	5.73	28.78
T_4 (D_2P_1)	5.64	027	18.86	5.63	30.44
T_5 (D_2P_2)	5.73	0.38	20.04	5.40	29.22
T_6 (D_2P_3)	6.35	0.44	21.30	5.57	34.33
T_7 (D_3P_1)	6.81	0.50	15.10	5.70	32.55
T_8 (D_3P_2)	5.49	0.56	12.42	5.10	32.45
T_9 (D_3P_3)	5.91	0.59	15.95	5.53	29.00
T_{10} (D_4P_1)	6.55	0.54	12.05	4.97	28.45
T_{11} (D_4P_2)	6.24	0.68	13.58	4.97	27.78
T_{12} (D_4P_3)	5.98	0.69	13.65	4.80	31.67
Result	SIG	NS	SIG	NS	SIG
S.Em ±	± 0.19	±0.12	± 0.58	±0.24	±0.49
CD@ 5%	0.58	-	1.73	-	1.44

References

1. Adjahossou, D F. (2006). Effect of flower pruning on the tuber yield of four yam bean accessions (*Pachyrrhizus erosus*). Cahiers Agricultures, **15**(2): 213-219.
2. Belford, E J, Karim, A B and Schroder, P. (2001). Exploration of the tuber production potential of yam bean (*Pachyrrhizus erosus* L.) under field conditions in Sierra Leone. J. Applied botany, **75**(18): 31-38.
3. Denna Eriani Munandar., Saputra, Y. and Pradana, A P. (2023). Effect of shoot pruning interval and dosage of potassium fertilizer on growth and yield of yam bean (*Pachyrrhizus erosus* L.). International J. Research, **11**(2): 124-133.
4. Gao, K, Zhang, Z., Zhu, T. and Coulter, J A. (2020). The influence of flower removal on tuber yield and biomass characteristics of *Helianthus tuberosus* L. in a semi– arid area. Industrial Crops and Products, **150**(2): 15-20.
5. Oagile, O, Davey, M R. and Alderson, P G. (2007). An under-utilized legume with potential as a tuber and pulse crop. J. Crop Improvement, **20**(1-2): 53-71.

6. Panse, V G and Sukhatme, P V. (1995). Statistical methods for Agriculture workers. ICAR, New Delhi.
7. Rangana, S. (1977). Manual of Analysis of fruit and vegetable products. Tata McGraw Hill Publishing Company Ltd., New Delhi.
8. Veena Jadhav, Naik, K R. and Sanjana Joshi. (2018). Utilization of tuber crops in Western Ghats of Karnataka. The Pharma Innovation J., **11**(2): 1216-1219.
9. Yesaware, P S. (2014). 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.