



Effect of Sowing Dates and Flower Pruning on Chemical Properties and Shelf Life of Yam Bean (*Pachyrrhizus erosus* L.) Tubers

Priti P. Shevale^{a++*}, Pradnya S. Gudadhe^b,
A. S. Sarangkar^{c++} and O. G. Ghume^{d++}

^a Department of Vegetable Science, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India.

^b AICRP on Tuber Crops, Central Experimentation, Wakawali, Tal- Dapoli, Dist- Ratnagiri, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India.

^c Department of Fruit Science, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India.

^d Department of Agricultural Botany, College of Agriculture, Dhule, Mahatma Phule Krishi Vidyapeeth, Rahuri, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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⁺⁺ M. Sc. Scholar;

*Corresponding author: E-mail: pritishevale2@gmail.com;

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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 tubers. An experiment was conducted at Department of Vegetable Science, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during the year 2023-24. Twelve treatments and 3 replications in Factorial Randomized Block Design Planting dates (D) *i.e.*, D₁-1st week of June, D₂-3rd week of June, D₃ -1st week of July, D₄ -3rd week of July and Interval of reproductive pruning (P) *i.e.*, P₁ – Weekly, P₂ – Fortnightly, P₃ – 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 D₃P₁ (6.81%). The fiber content was analysed highest in D₄P₃ (0.69 %). The highest dry matter content was analysed in D₁P₃ (24.59 %). The highest TSS was recorded in D₁P₁ (6.40 °B) and highest shelf life was recorded in D₁P₁ (36.56 days). 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 [1].

Keywords: Yam bean; shelf life; starch; TSS; fiber; dry matter; sowing dates; 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 play a vital role in sustainable farming and food security of the country” [2].

“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” [3]. 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 [4,5].

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 to find out suitable planting and effect of flower pruning on chemical properties of yam bean and the result would benefit the growers and producers [6].

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- 2024. 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)

D ₁	1 st week of June
D ₂	3 rd week of June
D ₃	1 st week of July
D ₄	3 rd week of July

Factor 'B'- Interval of flower pruning (P)

P ₁	Weekly
P ₂	Fortnightly
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 was 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 [8]. 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 D₄ (6.25%) which were at par with the D₃ (6.06 %). However, the lowest starch content recorded in D₁ (5.02%). The highest fiber content was recorded in D₄ (0.57 %) and the lowest was recorded in D₁ (0.45 %). The highest dry matter content was recorded in D₁ (20.43%) which was at par with D₂ (20.06%). Whereas, the lowest dry matter content observed in D₄ (13.09%). The highest TSS content was recorded in D₁ (5.95 °B). However, the lowest was found in D₄ (4.91 °B). The highest shelf life was found in D₁ (33.11 days) which was significantly superior over rest of treatments. However, the lowest shelf life was recorded in D₄ (29.29 days). Sowing at optimal times generally enhanced the chemical properties and shelf life tubers as the plants fully matured and assimilated more resources.

This results are confirmatory with the Lowerence et al. [9] in pigeon pea, Gao et al. [10] in *Helianthus tuberosus* L. and Deena, et al. [11] in yam bean.

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 P₁ (6.04 %) which was at par with P₃ (5.87%). Whereas, the lowest starch was reported in P₂ (5.52 %). The highest fiber content was recorded in P₃ (0.6 %) and lowest was recorded in P₁ (0.40 %). The highest dry matter content was found in P₃ (18.87%). Whereas, the lowest was found in P₁ (15.28%). The highest TSS was recorded in P₁ (5.67 °B). Whereas, the lowest TSS recorded in P₂ (5.30 °B).

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 (1 st week of June)	5.02	0.45	20.43	5.95	33.11
D ₂ (3 rd week of June)	5.90	0.50	20.06	5.53	31.33
D ₃ (1 st week of July)	6.06	0.53	14.46	5.44	31.33
D ₄ (3 rd 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

The highest shelf life was observed in P₁ (32 days). However, the lowest was found in P₂ (30.86 days). Flower removal redirected energy from flower and seed production to tuber growth, potentially increase the starch, dry matter, TSS, Fiber and shelf life.

Similar findings reported by Belford et al. [12] in yam bean. Nisha Kumari Meena et al. [13] in sweet potato and Adjahossou [14] 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 D₃P₁ (6.81%) which was at par with D₄P₁ (6.55%), D₂P₃ (6.35%) and D₄P₂ (6.24%). However, the lowest starch was recorded in D₁P₂ (4.66%).

The highest fiber content in tuber was observed in D₄P₃ (0.69%) which was at par with the D₄P₂ (0.68%), D₃P₃ (0.59%), D₃P₂ (0.56 %) and D₄P₁ (0.54%). However, the lowest fiber content was observed in D₁P₁ (0.25%).

The highest dry matter was recorded in D₁P₃ (24.50%). Whereas, the lowest dry matter content recorded in D₄P₁ (12.05%).

The highest TSS of tuber was recorded in D₁P₁ (6.40 °B). However, the lowest TSS was recorded in D₄P₃ (4.80 °B).

The highest shelf life was found in D₁P₁ (36.56 days). However the lowest was found in D₄P₂ (27.78 days). Combining optimal sowing dates with flower removal maximized starch content and dry matter, enhanced TSS and improved the overall shelf life of yam bean tubers, highlighting the importance of these factors in cultural practices.

Similar findings reported by Belford et al. [12] in yam bean, Geregwerigis et al. [15] in potato, Adjahossou [14] in yam bean, Mardhiana Pradhana [16] in cucumber, Gao et al. [10] in *Helianthus tuberosus* L. and Deena, et al. [11] in yam bean [17].

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 ₁ P ₁)	5.16	0.25	15.20	6.40	36.56
T ₂ (D ₁ P ₂)	4.66	0.38	21.51	5.73	34.00
T ₃ (D ₁ P ₃)	5.26	0.30	24.59	5.73	28.78
T ₄ (D ₂ P ₁)	5.64	0.27	18.86	5.63	30.44
T ₅ (D ₂ P ₂)	5.73	0.38	20.04	5.40	29.22
T ₆ (D ₂ P ₃)	6.35	0.44	21.30	5.57	34.33
T ₇ (D ₃ P ₁)	6.81	0.50	15.10	5.70	32.55
T ₈ (D ₃ P ₂)	5.49	0.56	12.42	5.10	32.45
T ₉ (D ₃ P ₃)	5.91	0.59	15.95	5.53	29.00
T ₁₀ (D ₄ P ₁)	6.55	0.54	12.05	4.97	28.45
T ₁₁ (D ₄ P ₂)	6.24	0.68	13.58	4.97	27.78
T ₁₂ (D ₄ P 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

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. 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.

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.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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