"Varietal Evaluation Of Pak Choi (*Brassica rapa subsp chinensis*) Under Prayagraj Agro-Climatic Conditions"

ABSTRACT

An experiment was conducted on Varietal Evaluation Of Pak Choi during 2022 using ten different varieties at the Horticultural Farm, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P). The observations were recorded on various growth and yield contributing characters. It is evident from the results of the present investigation that on the basis of mean performance of ten varieties, the variety Pak Choi White Stem was found to be superior on the basis of growth, having the maximum plant height (22.57cm) and gross weight (133.75g). In terms of yield/ha (q), Pak Choi White Stem (70.67) and Desi Pak Choi (69.22) was found to be superior. In terms of economics, the maximum gross return per hectare was obtained by Pak Choi White Stem i.e. 212010 INR followed by Desi Pak Choi i.e.,207660 INR.

Keywords : Pak choi, growth, yield, economics.

INTRODUCTION

Pak Choi or Bok Choy (*Brassica rapa* subsp. *chinensis*) is an important leafy vegetable belonging to the family Brassicaceae. It has a chromosome no. of 2n=18. This member of the cabbage family has a number of different names, including pak choi, bok choy, Chinese celery cabbage and white mustard cabbage**(Aydın,2012).** It is grown in Asia, where the earliest reports of their use are from the fifth century A.D. and traces its origins from China. It has been cultivated in southern China, particularly in the East, Northeast, and Southeast Asia for more than 1600 years ago**(Wang and Kole, 2015).**

Pak choi is a non-heading type of Chinese cabbage that typically grows to a height of about 20-30 cm (8-12 inches) and forms a cluster of glossy, dark green leaves **(Peirce,1987)**. While it grows slower in less light, it can easily tolerate as little sun as 2 hours a day. This annual vegetable has optimal growth and development at temperatures between 15°C and 20°C .

Pak Choi are consumed in different forms. The plant is being used mostly for its leaves and leaf stalks. Botanically, pak choi is classified as a cool-season crop and is known for its ability to tolerate colder temperatures. Its leaves are smooth and shiny, with a shape that ranges from long and slender to round and broad. The plant also features thick, succulent stalks that are crisp and tender **(Podsedek, 2007).**

The yield of non-heading Chinese cabbage is closely associated with the premature formation of flower stalks. The impact of growing time may be significant in this regard, which is controlled by temperature and environmental conditions (**Artemyeva and Solovyeva, 2006**).

MATERIALS AND METHODS

The experiment was conducted during the year 2022 at the Horticulture Farm in the Department of Horticulture and Sciences, Naini Agriculture Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj. The area is situated on the south of Prayagraj on the right bank of Yamuna at Rewa road at a distance of about 6 km from Prayagraj city. It is situated at the 250.8^0N Latitude and 810.50^0E meters from sea level. Prayagraj has a sub-tropical climatic with uttermost in summer (in the month of May and June) with temperate reaching around 115^0F with hot blazing winds and in winter (December and January the temperature falls down as low as 32^0F. The average rainfall is around 1013.4 (mm) annually with maximum concentration during July to September with occasional showers in winter. The experiment was laid out in Randomized Block Design (RBD), 10 varieties of pak choi with 3 replication each.

RESULTS AND DISCUSSION

In the present experiment, a research has been conducted to evaluate the different varieties of pak choi (*Brassica rapa* subsp. c*hinensis)* at Prayagraj agro-climatic conditions. The morphological growth parameters are namely days taken to germination, number of leaves, plant height(cm), diameter of loose head(cm), net weight(g), gross weight(g), chlorophyll content and days to harvest and yield parameters are plant weight(g), yield per plot(kg) and yield per hectare(q). The results are presented in table 1,2 and 3.

1.GROWTH PARAMETERS

The number of days taken to germination emergence was recorded minimum in the varieties Emerald Green (3.27), Pe-Tsai (3.60), Desi Pak Choi (3.67) and Pak Choi White Stem (3.73), Baby Pak Choi (3.73), Hong-Tae(3.87), which were on par with each other, while the maximum number of days taken for germination was reported in the variety Purple Lady Pak Choi (4.45) , Canton Milky Dwarf (4.40). The seed germination and seedling growth parameters showed different variation in their performance with respect to the different genotypes taken. Similar findings were reported by **Verma R., Maurya, B. R., & Meena V. S. *et al.*,(2014)** and **Guımaraes, V.F. (2015) *et al.*** in Pak Choi.

The number of leaves per plant at 45 days in different varieties of pak choi was recorded minimum in the varieties Purple Lady Pak Choi (4.73) and Canton Milky Dwarf (4.80) which were found to be at par with each other, whereas the maximum was recorded in the varieties Pe-Tsai (11.20), followed by Pak Choi White Stem (8.93) and Hong-Tae (8.67). Similar variations among varieties with respect to number of leaves were reported by several workers, **Cho Y.Y. & Son, J.E *.et al*., (2007)** and **Biao Zhu, Jing Y. , Zhu-jun Z. *et al.*, (2013).**

The plant height at 45 DAS was found to be the maximum in the varieties Pak Choi White Stem (22.57 cm) followed by Desi Pak Choi (19.80 cm) , Green Import Oriental (18.67cm), Pak Choi All Green(18.16 cm), Canton Miky Dwarf (17.63cm), Emerald Green (17.47cm) and Pe-Tsai (17.47cm) which were on par.
Whereas the minimum plant height was found to be in Baby Pak Choi (8.80 cm), Hong Tae (14.07 cm) and Purple Lady Pak Choi (16.87 cm). Similar findings were also

observed by **Archana P Pant, Radovich, T. J., , Nguyen V. Hue, Talcott, S. T., & Krenek, K. A. *et al* (2009).**

The diameter of loose head was measured and recorded the maximum in the variety Pak Choi White Stem (58.27), Desi Pak Choi (54.60), Pe Tsai (46), Green Import Oriental (43.47), Pak Choi All Green (42.07) which were on par with each other while the minimum diameter was found in Canton Milky Dwarf (16.07), Hong Tae (32.95), Purple Lady Pak Choi (34.07), Emerald Green (37.27) and Baby Pak Choi (41.07). The results are in conformity with the findings of **Phillips R *et al.*,(1993) ,Prabhakar BS *et a*l.,(1993)** and **Splittstoesser WE *et al* 1979.**

The maximum chlorophyll content was recorded in Pak Choi All Green (54.83), Green Imported Oriental (45.0), Emerald Green(44.81), Pe-Tsai (44.30) and Pak Choi White Stem(43.31) which were found to be at par. Whereas the minimum chlorophyll content was recorded in Purple Lady Pak Choi (34.91), Desi Pak Choi (36.55), Baby Pak Choi (38.33) respectively. The results are in conformity with the findings of **Harbaum, B., Hubbermann, E.M., Zhu, Z. & Schwarz, K. *et al.*, 2008.**

The minimum number of days of first harvesting was recorded in the genotypes Desi Pak Choi (42), Pak Choi White Stem (43) , Baby Pak Choi (45), Green Import Oriental (45) which were on par with each other and maximum number of days to first harvesting (65.67) was reported in the variety Purple Lady Pak Choi, Canton Milky Dwarf (48), Hong Tae (46.8), All Green (46), Emerald Green (45.67). These variations in results agree with the findings of **Able, A.J., L.S. Wong, A. Prasad, T.J. O'Hare. 2005.**

Table 1. Growth parameters of different Pak Choi varieties

Varieties	Days taken to germination	No. Of leaves	Plant height(cm)	Diameter of loose head (cm)	Chlorophyll content	Days to harvest
Baby Pak Choi	3.73	7.47	8.80	41.07	38.33	45
Desi Pak Choi	3.67	8.67	19.80	54.60	36.55	42
Pak Choi White Stem	3.73	8.93	22.57	58.27	43.31	43
Pak Choi All Green	4.27	7.07	18.16	42.07	54.83	46
Green Import Oriental	4.33	8.73	18.67	43.47	45.0	45
Emerald Green	3.27	8.67	17.47	32.27	44.81	45.67
Canton Milky Dwarf	4.40	4.80	17.63	16.07	44.15	48
Hong Tae	3.87	8.67	14.07	32.95	44.8	46.8
Pe-tsai	3.60	11.20	17.47	46.0	44.30	45.73
Purple Lady Pak Choi	4.45	4..73	16.87	34.07	34.91	65.67

2. YIELD PARAMETERS

The maximum plant weight was recorded in Pak Choi White Stem (90.07g) followed by Desi Pak Choi (89.57), Pak Choi Emerald Green (89), Pak Choi All Green (76.60) and Pe-Tsai (72.30) which were found to be at par. Whereas the minimum plant weight was recorded in Purple Lady Pak Choi (50.77g), Canton Milky Dwarf (53.08), Green Import Oriental (53.23) followed by Baby Pak Choi (55.8g),respectively. The results are in conformity with the findings of **Purbajanti E D., Setyowati D S., *et al.*,(2020) and Mohamad, Nur Suhaida, Abu Kassim, Faizah, Usaizan, Norhanizan, Hamidon, Azimah & Safari, Zahir Shah *et al.*,(2021).**

The maximum gross weight of each plant was recorded in Pak Choi White Stem (133.75g) followed by Desi Pak Choi (125.35g) and Green Import Oriental (108.76g) which were found to be at par. Whereas the minimum plant gross weight was recorded in Purple Lady Pak Choi (46.70g), Emerald Green (53.17g), Canton Milky Dwarf (55.80g), Baby Pak Choi (77.48g), Pe-Tsai (78.85), All Green (80.46) and Hong-Tae (82.40). The results are in conformity with the findings of **Vanparys, L. (1999).**

The yield of pak choi was recorded minimum in the variety Purple Lady Pak Choi (461.10g), Canton Milky Dwarf 615.15g), Green Import Oriental (645.13g), Hong Tae (608.35g), Baby Pak Choi (620.10g), Pak Choi All Green (668.5g), Emerald Green(743.21g), Pe-Tsai (608.35g) which was found to be at par, and the maximum yield was recorded in Pak Choi White Stem (1225.30g), .Desi Pak Choi (790.10g) and Emerald Green (743.21). The results are in agreement with the findings of **D Balkaya, A.*et al*., (2012)** and **Dalastra, G.M.*et a*l.,(2015).**

The yield per hectare was recorded and observed to be the minimum in the variety Purple Lady Pak Choi (45.80), Baby Pak Choi (50.15), Emerald Green (58.76), Canton Milky Dwarf (63.16), Green Imported Oriental (63.92), Hong Tae (67.17) and Pak Choi All Green (68.23) which was found to be at par, and the maximum yield per hectare was recorded in Pak Choi White Stem (70.67), Desi Pak Choi (69.22) and Pe-Tsai (68.25). This study is supported by the similar findings of **Acikgoz, F.E. and S. Altintas. et *al.*, (2011).**

Varieties	Net weight (g)	Gross weight (g)	Yield per plot (g)	Yield per hectare (q/h)
Baby Pak Choi	55.8	774.8	620.10	50.15
Desi Pak Choi	89.57	125.35	790.10	69.25
Pak Choi White Stem	90.07	133.75	1225.30	70.67
Pak Choi All Green	76.60	80.46	668.55	68.23
Green Import Oriental	53.23	108.76	645.13	63.92
Emerald Green	89.0	53.17	743.21	58.76
Canton Milky Dwarf	53.08	55.80	615.15	63.16

Hong Tae	65.27	82.40	681.25	67.17
Pe-tsai	72.30	78.85	608.35	68.17
Purple Lady Pak Choi	50.77	46.70	461.10	45.80

Table 2. Yield parameters of different Pak choi varieties

3. ECONOMICS OF DIFFERENT PAK CHOI GENOTYPES

The economics of the pak choi genotypes was calculated by summed cost of all agronomic practices, protection measures, land etc including labour and farm machinery. The total cost of cultivation is (INR 81,800).

The total yield of a particular variety is multiplied by marked price of pak choi at a time. The total cost of cultivation is subtracted from total income, all the middleman margins and market charges were subtracted from total income to determine the net return.

3.1 Gross return hectare

The maximum gross return per hectare was obtained by Pak Choi White Stem i.e. 212010 INR followed by Desi Pak Choi i.e.,207660 INR and the minimum gross return hectare by Purple Lady Pak Choi i.e. 137400 INR.

3.2 Net return per hectare

The maximum net income per hectare was obtained by Pak Choi White Stem i.e.130210 INR followed by Desi Pak Choi i.e., 125860 INR and the minimum net return per hectare was obtained by Purple Lady Pak Choi i.e.,55600 INR.

3.3Cost benefit Ratio

Among the different pak choi genotypes Pak Choi White Stem has the highest cost benefit ratio i.e. 2.6 , followed by Desi Pak Choi i.e.,2.5 and the minimum cost benefit ratio was obtained in Purple Lady Pak Choi i.e. 1.6.

Table 3. Cost benefit ratio

Variety	Total cost of cultivation/ha.	Selling Rate (Rs/q)	Yield q/ha.	Gross return @Rs.3000/q) (Rs./ha.)	Net return (Rs/ha)	Cost Benefit ratio
Baby Pak Choi	81,800	3000	50.15	150,450	68,650	1.83
Desi Pak Choi	81,800	3000	69.22	207,660	125,860	2.5
Pak Choi White Stem	81,800	3000	70.67	212,010	130,210	2.6
Pak Choi All Green	81,800	3000	68.23	204,690	122,890	2.5
Green Imported Oriental	81,800	3000	63.92	191,760	109,960	2.3

Emerald Green	81,800	3000	58.76	176,280	94,480	2.1
Canton Milky Dwarf	81,800	3000	63.16	189,480	107,680	2.3
Hong Tae	81,800	3000	67.17	201,510	119,710	2.4
Pe-Tsai	81,800	3000	68.24	204,720	122,920	2.5
Purple Lady Pak Choi	81,800	3000	45.80	137,400	55,600	1.6

CONCLUSION

From the above experiment, it can be concluded that the variety Pak Choi White Stem was found to be best in terms of growth parameters. However, on the basis of earliness parameters, V7 Canton Milky Dwarf performed best. On the basis of yield parameters, the variety Pak Choi White Stem was found to be the best. In terms of both growth and yield parameters, the variety Purple Lady Pak Choi was found to be the least suitable. The highest gross return was found in V3 Pak Choi White Stem and the B:C ratio was found in the same with 2.6.

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Appendix 1.

41.07	38.33

54.60	36.55
58.27	43.31
42.07	54.83
43.47	45.0
32.27	44.81
16.07	44.15
32.95	44.8
46.0	44.30
34.07	34.91