Original Research Article

# VARIETAL EVALUATION OF HYBRID CABBAGE (*Brassica oleraceae var.* capitata L.) UNDER PRAYAGRAJ AGRO- CLIMATIC CONDITIONS"

**Abstract**

An experiment on cabbage was conducted during October (2021) to Feburary (2022), in horticulture Research field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, and Technology and Sciences Prayagraj (U.P) India. The results of investigation, regarding the Evaluation of the 12 varieties of Cabbage *i.e.,* $V_1$ (Cabbage F1 Hybrid NBH- Arun) , $V_2$ (Cabbage F1 Hybrid royal vantage), $V_3$ (Hybrid cabbage Kashi (22)), $V_4$ (Cabbage NS 22), $V_5$ (Green Hero), $V_6$ ( F1- Hybrid cabbage fieldman), $V_7$(J K Green King F1- Hybrid Seed), $V_8$ ( Green Top- F1), $V_9$( Hybrid Gayatri), $V_{10}$( Cabbage- Bio Samrat), $V_{11}$(Cabbage- F1 Lucky Ball) and $V_{12}$( F1 Hybrid Indam-296) obtained from different sources to find out the best performance in terms of growth and yield in Prayagraj agro climatic conditions. The experiment was conducted in Randomized Block Design, were each hybrid replicated thrice the results from the present investigation Concluded that Cabbage varieties JK Green king F1- Hybrid was recorded with minimum days for germination (8.50), plant height (32.72), Number of leaves (16.92), Plant spread (2633.47), Marketable Head Yield (1571.95), Net Head Yield (1324.18), Head Yield (t/ha) (256.16), TSS (8.61), Ascorbic Acid (29.66), Fiber content (16.16), Head equatorial diameter (10.98), Head polar Diameter (12.71), Head Compactness (37.47) and with maximum Benefit cost ratio (3.64).

***Keywords:*** *Cabbage, Varieties, Agro-climatic conditions.*

## INTRODUCTION:

Cabbage (*Brassica oleraceae* var. capitata) is one of the most important leafy vegetables worldwide **(Talekar, 2000).** It originated from a wild non heading type, 'cole wart' (*Brassica Oleracea* var. sylvestris) and considered the real headed cabbage evolved in Germany. Cabbage belongs to the family of Brassicaceae and geuns of Brassica. Cabbage (*Brassica Oleracea* var. Capitata) is one of the most popular vegetables in the world because of its adaptability to a wide range of climatic conditions and soil types, ease of production and storage, and its food value. It is believed to have evolved from a wild form native to Europe, growing along the coast of the North Sea, the English Channel and northern Mediterranean. Cabbage has been ranked by the Food and Agriculture Organization among the top twenty vegetable crops grown, establishing it as an important food source, globally **(FAO, 1988).** Area and production of cabbage was 397 ha and 9207 MT respectively **(NHB 2020)** Cabbage is a cool season crop which grows best under cool, moist weather conditions **(Thompson, 2002).** The cabbage is a crop plant that is easily grown on a wide range of soil types and is adaptable to many different climatic conditions **(Smith, 1995).** It can be cultivated throughout the year if proper varieties are selected and planted. It favors in cold climate and soil pH with 5.5 to 6.5. Cabbage yield and yield characteristics are determined by several factors, such as variety, plant spacing, environmental conditions and market requirements, among others. Days to maturity, or earliness, in cabbage is largely determined by variety, and is a desirable characteristic when varieties with short growth cycles are required to meet market demands **(Cervenski, et al., 2012)** Commercial cultivation of cabbage is very successful due to high market demand. In the recent years, hybrid cabbage cultivation is increasing. Cabbage is a good source of vitamin C and sulphur. Cabbage helps with constipation. Cabbage helps with gastric ulcers. There is a

wide scope of increasing cabbage production with the introduction of new suitable cultivars from abroad. There are many cabbage varieties available in the market, which have been imported by different seed companies. Prior to recommendation for farmers, varietal evaluation needs to be determined. Otherwise farmers will be deprived of getting benefit from cabbage cultivation. The objective of this study was to evaluate the yield and growth characteristics of 12 cabbage varieties in order to determine the best suited to growing conditions, particularly season and location.

**Materials and methods:**

The experiment was conducted Central Horticulture Research farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, and Technology and Sciences Prayagraj (U.P) India during 2020-2021. The experiment was laid out in RBD (Randomized Block Design) having 12 varieties with 3 replications of hybrid varieties of cabbage tabulated-1. Cabbage varieties were sown in the field at a spacing of 60 x 45 cm in the plot of 2m x 1m size. The standard recommended dose of fertilizers (200: 120:80 NPK kg/ha + 15 ton FYM/ha)was applied and Normal cultural practices and plant protection measures were followed during the cultivation process.

**Table 1: List of Hybrid Varieties**

| SI.NO | VARIETIES | NAME OF HYBRID | SOURCE |
|---|---|---|---|
| 1. | $V_1$ | CABBAGE F1 HYBRID NBH-ARUN | NOBLE SEEDS PVT.LTD |
| 2. | $V_2$ | CABBAGE F1 HYBRID ROYAL VANTAGE | SAKATA SEED INDIA (P) LTD |
| 3. | $V_3$ | HYBRID CABBAGE KASHI (22) | AKSHAY SEEDS PVT.LTD |
| 4. | $V_4$ | CABBAGENS 22 | NAMDHARI SEEDS PVT.LTD |
| 5. | $V_5$ | GREEN HERO | TAKII-SEEDS INDIA PVT.LTD |
| 6. | $V_6$ | F1-HYBRID CABBAGE FIELDMAN | KALASH SEEDS PVT.LTD |
| 7. | $V_7$ | JK GEEN KING F1-HYBRID SEED | JK-AGRI GENETICS LTD. |
| 8. | $V_8$ | GREEN TOP-F1 | EAST-WEST SEED INTERNATIONAL |
| 9. | $V_9$ | HYBRID GAYATRI | Doctor Seeds PVT. LTD |
| 10. | $V_{10}$ | CABBAGE-BIOSAMRAT | BIOSEED |
| 11. | $V_{11}$ | CABBAGE-F1LUCKY BALL | LUCKY-SEEDS PRIVATE LIMITED |
| 12. | $V_{12}$ | F1 HYBRIDINDAM-296 | INDO-AMERICAN HYBRID-SEED (INDIA)PVT.LTD. |

The data recorded during the course of investigation were subjected to statistical analysis as per method of analysis of variance **Fisher (1960)**. The significance and non-significance of the treatment effect were judged with the help of 'f' value (variance ratio) was compared with the table value at 5% level of significance. If calculated value exceeded then the value, the effect of considered to be significant. The significant difference between the means was tested against the critical difference at 5% level of significance.

**Chemical analysis of soil**

Composite soil samples are collected randomly before the layout of experiment was laid so as to determine the soil properties initially. The soil samples are collected from 0-15 cm depth and were dried under shade, then powdered with the help of a wooden pestle and mortar then sieved through a 2 mm sieve and was then subjected to further analysis. The physical properties of soil were evaluated by using the Bouyoucos hydrometer method outlined by **Bouyoucos (1952)** and for organic carbon by Wet method **Walkely and Black (1956).** Available nitrogen (260.14 kg/ha) was estimated by alkaline permanganate method by **Subbiah and Asija (1956**), available phosphorus (133kg/ha) by Olsen method by **Olsen *et al.*, (1954),** available potassium (145.23 kg/ha) was determined by use of Flame Photometric method **(Toth and Prince *et al*., 1949)**.

**Results and Discussions**
**A.Growth parameters**
**Days to Germination:**

The statistically analysed data on Days to Germination of cabbage seeds are represented in table 2. It is clear from the table that there is significant difference among various hybrids of cabbage. The Minimum days to germination was found in $V_7$ (JK green King F1- Hybrid Seed) which was found 8.50 followed by $V_9$ (Hybrid Gayatri) which was 9.00 and the maximum Germination days was foundin varieties $V_6$ (F1- Hybrid Cabbage Fieldman) which was 14.50 which are statically at par value respectively. The number of days to germination is an important character. which indicate earliness or lateness of the crop in general. Better germination in this hybrid may be due to genetic potential or having the better permeability of seed coat to water hence earlier initiation of germination. The earlier and late germination helps in the occurrence of early/late flush of crop which is advantageous for market to fetch the higher price. The view was supported by **Kamal *et al*. (2012), Narayan *et al.* (2013)** and **Chandra Leela *et al*. (2020)** in Bottle gourd. Similar findings also **gogoi *et al*., (2016)** in broccoli.

**Plant Height:**

The statistically analysed data on days to Plant Height of cabbage seeds are represented in table 2. It is clear from the table that there is significant difference among various hybrids of cabbage. The maximum Plant Height was found in varieties $V_7$ (JK green King F1- Hybrid Seed) which was found 26.22 followed by $V_9$ (Hybrid Gayatri) which was 25.58, $V_{12}$ (F1 Hybrid Indam-296) (24.19) which are statically at par value and minimum was found in $V_6$ (F1- Hybrid Cabbage Fieldman) which was 19.35 in 30 DAT.The maximum plant height was found in varieties $V_7$ (JK green King F1- Hybrid Seed) 31.07 followed by $V_9$ (Hybrid Gayatri) which was 30.26, $V_{12}$ (F1 Hybrid Indam-296) (30.17), $V_5$ (Green Hero) (29.42) which are statically at par value and minimum was found in $V_6$ F1- Hybrid Cabbage Fieldman which was 27.72 in 60 DAT. The maximum plant height was found in varieties $V_7$ (JK green King F1- Hybrid Seed) (32.72) followed by $V_9$ (Hybrid Gayatri) which was 32.56, $V_{12}$ (F1 Hybrid Indam-296) (31.81), $V_5$ (Green Hero) (31.88) which are statically at par value and minimum was found in $V_6$ F1-

Hybrid Cabbage Fieldman which was 16.29 and minimum was found in $V_6$ F1- Hybrid Cabbage Fieldman which was 30.68 in 90 DAT respectively. This variation in plant height could be due to variation in the genetic make- up of different varieties. Environmental conditions caused variation in the hormonal balance and cell division rate that result in changes in the plant height of the different varieties. The results of this study are in agreement with **Gaurav, Srivastava., *et al*.(2019)**

**Number of Leaves:**

The statistically analysed data on days to Number of Leaves of cabbage seeds are represented in table 2. It is clear from the table that there is significant difference among various hybrids of cabbage. The maximum number of leaves was at 30 DAT found in varieties $V_7$ (JK green King F1- Hybrid Seed) which was found 8.59 followed by $V_9$ (Hybrid Gayatri) (8.29) which are statically at par value and minimum plant spread found in $V_6$ (F1- Hybrid Cabbage Fieldman) which was 5.44 respectively.The maximum number of leaves was at 60 DAT found in varieties $V_7$ (JK green King F1- Hybrid Seed) which was 14.63 and minimum number of leaves $V_6$ (F1- Hybrid Cabbage Fieldman) which was 9.96 respectively.The maximum number of leaves was at 90 DAT found in varieties $V_7$ (JK green King F1- Hybrid Seed) which was 16.92 and minimum was found in $V_6$ F1- Hybrid Cabbage Fieldman which was 16.29 respectively. The variation in number of leaves per plant under different varieties, might be due to differences in their genetic inherent capacity, and suitability under this climate. The lower numberof leaves in some cultivars was probably due to slow rate in leaf initiation. The mean Number of leaves of varieties of cabbage was found significant at different stages. Similar findings also reported by **Thapa and Rai (2012)** in broccoli.

**Plant Spread:**

The statistically analysed data on days to Plant Spread of cabbage seeds are represented in table 2. It is clear from the table that there is significant difference among various hybrids of cabbage. The maximum plant spread in 30 DAT was found in V7 (JK green King F1- Hybrid Seed) which was found 1040.45 which are statically at par value and minimum plant spread found in V6 (F1- Hybrid Cabbage Fieldman) which was 594.41 respectively.The maximum plant spread in 60 DAT was found in V7 (JK green King F1- Hybrid Seed) which was found 1873.67 which are statically at par value and minimum plant spread found in V6 (F1- Hybrid Cabbage Fieldman) which was 1126.42 respectively.The maximum Plant Spread in 90 DAT was found in varietiesV7 (JK green King F1- Hybrid Seed) which was found 2633.47 followed by $V_9$ (Hybrid Gayatri) which was 2632.33, $V_{12}$ (F1 Hybrid Indam-296) (2607.89), $V_5$ (Green Hero) (2604.35), $V_3$(Hybrid Cabbage kasha) (2526.32), $V_4$(Cabbage NS 22) (2414.83), $V_1$(Cabbage F1 Hybrid NBH-ARUN) (2333.55) which are also statically at par value and minimum plant spread was found in V6 (F1- Hybrid Cabbage Fieldman) which was 773.20 90 DAT respectively. Because of the capacity of genotype to intake more water and ability of the genotype to grow fast in the condition like sunlight, moisture, temperature and the number of days to second true leaf emergence indicate earliness or lateness of flowering. Based on the ability of genotype which induces both cell division and cell elongation **(Jones,1979**), **(Jacob, M., *et al*., 2016) and (Kamal, N., *et al*., 2012).** similarly, it can stimulate plant tissue results in enhanced vegetative growth.

**Table-2. Performance of cabbage varieties in terms of Days to germination, Plant height (cm), Number of leaves, Plant Spread (cm).**

| Varieties | Days to germination | Plant height (cm) | Number of leaves | Plant Spread (cm) |
|---|---|---|---|---|
| $V_1$ | 10.17 | 30.68 | 14.51 | 2333.55 |
| $V_2$ | 11.67 | 28.13 | 13.29 | 2117.46 |
| $V_3$ | 9.83 | 31.50 | 13.44 | 2526.32 |
| $V_4$ | 10.00 | 30.88 | 15.74 | 2414.83 |
| $V_5$ | 9.67 | 31.72 | 15.77 | 2604.35 |
| $V_6$ | 14.50 | 30.07 | 16.29 | 2002.75 |
| $V_7$ | 8.50 | 32.72 | 16.92 | 2633.47 |
| $V_8$ | 13.00 | 29.96 | 14.37 | 2037.18 |
| $V_9$ | 9.00 | 32.56 | 17.59 | 2632.33 |
| $V_{10}$ | 13.50 | 28.52 | 16.03 | 2017.73 |
| $V_{11}$ | 11.50 | 30.35 | 15.14 | 2165.22 |
| $V_{12}$ | 9.50 | 31.81 | 14.92 | 2607.89 |
| **F test** | **S** | **S** | **S** | **S** |
| **S. Ed (±)** | 0.40 | 0.53 | 0.39 | 2.05 |
| **C.D at 5%** | 4.53 | 2.11 | 3.17 | 0.10 |
| **C.V.** | 0.84 | 1.10 | 0.82 | 4.27 |

**B. Yield Parameters:**

**Marketable Head Yield:**

The statistically analysed data on days to Marketable Head Yield of cabbage seeds are represented in table 3. It is clear from the table that there is significant difference among various hybrids of cabbage. The maximum Marketable yield was found in varieties $V_7$ (JK green King F1- Hybrid Seed) which was found 11571.95 and minimum was foundin $V_6$ F1- Hybrid Cabbage Fieldman which was 773.20 90 DAT respectively. The yield attributes are significantly influenced by genetic potential of the plant attributed to higher biomass accumulation coupled with effective translocation and distribution of photosynthates from source to sink, which in turn resulted into elevated stature of yield attributes, which of course was due to favorable weather conditions such as rainfall distribution, evaporation and relative humidity prevailed during the crop growth period. Similar findings of the experiment was concluded by **Surendra Lal Shrestha (2019)** in cabbage.

**Net Head Yield:**

The statistically analysed data on days to Net Head Yield of cabbage seeds are represented in table 3. It is clear from the table that there is significant difference among various hybrids of cabbage. The maximum Net Head yield was found in varieties $V_7$ ( JK green King F1- Hybrid Seed) which was found 1324.18 and minimum was foundin $V_6$ F1- Hybrid Cabbage Fieldman which was 524.59 at 90 DAT respectively. The yield attributes are significantly influenced by genetic potential of the plant attributed to higher biomass accumulation coupled with effective translocation and distribution of photosynthates from source to sink, which in

turn resulted into elevated stature of yield attributes, which of course was due to favourable weather conditions such as rainfall distribution, evaporation and relative humidity prevailed during the crop growth period. Similar findings of the experiment was concluded by **Surendra Lal Shrestha (2019)** in cabbage.

**Head Yield:**

The statistically analysed data on days to Head Yeild of cabbage seeds are represented in table 3. It is clear from the table that there is significant difference among various hybrids of cabbage. The maximum Head yield was found in varieties $V_7$ ( JK green King F1- Hybrid Seed) which was found 256.16 followed by $V_9$ (Hybrid Gayatri) which was 255.66 which are also statically at par value and minimum was found in $V_6$ F1- Hybrid Cabbage Fieldman which was 235.83 at 90 DAT respectively. The higher yield plant$^{-1}$ (kg) due to its inherent characteristics, better adoptability for the environmental conditions and efficiently all available factors viz. water, nutrient,light and $CO_2$. None of the treatments significantly influenced the plant stand. This indicates that whatsoever differences were observed in growth and yield attributes weremainly due to different hybrid effect. The results are in agreement with the finding of **Kamal *et al*. (2012), Shinde *et al*. (2014)** and **Deepthi *et al*. (2016)** in Bottle gourd.

**Table-3. Performance of cabbage varieties in terms of Yield parameters.**

| Varieties | Marketable Head yield | Head Polar diameter | Head equatorial diameter | Net head weight | Head yield |
|---|---|---|---|---|---|
| $V_1$ | 1156.34 | 9.98 | 10.44 | 715.62 | 249.83 |
| $V_2$ | 1043.66 | 9.8 | 10.2 | 677.52 | 245 |
| $V_3$ | 1234.93 | 10.19 | 10.61 | 824.81 | 252.5 |
| $V_4$ | 1213.15 | 10.03 | 10.7 | 764.86 | 251.16 |
| $V_5$ | 1236.93 | 11.21 | 10.64 | 833.70 | 252.63 |
| $V_6$ | 773.20 | 9.16 | 8.41 | 524.59 | 235.83 |
| $V_7$ | 1571.95 | 12.71 | 10.98 | 1324.18 | 256.16 |
| $V_8$ | 953.43 | 9.52 | 9.79 | 661.95 | 242.16 |
| $V_9$ | 1336.44 | 12.67 | 10.87 | 917.14 | 255.66 |
| $V_{10}$ | 844.34 | 9.35 | 8.59 | 633.26 | 239 |

| | | | | | |
|---|---|---|---|---|---|
| $V_{11}$ | 1115.56 | 9.93 | 10.24 | 704.70 | 245.33 |
| $V_{12}$ | 1311.76 | 12.21 | 10.83 | 916.67 | 253 |
| **F test** | **S** | **S** | **S** | **S** | **S** |
| **S. Ed (±)** | 2.38 | 0.37 | 0.40 | 2.44 | 1.30 |
| **C.D at 5%** | 0.25 | 4.29 | 4.81 | 0.38 | 0.64 |
| **C.V.** | 4.95 | 0.76 | 0.83 | 5.07 | 2.70 |

**C. Quality Parameters:**

**TSS Brix:**

The statistically analysed data on days to TSS Brix of cabbage seeds are represented in table 4. It is clear from the table that there is significant difference among various hybrids of cabbage.The maximum TSS Brix was found in varieties $V_7$ (JK green King F1- Hybrid Seed) which was found 8.61 followed by $V_9$ (Hybrid Gayatri) which was 8.34, $V_{12}$ (F1 Hybrid Indam-296) (8.27), $V_5$ (Green Hero) (8.22), $V_3$(Hybrid Cabbage kasha) (8.17), $V_4$(Cabbage NS 22) (8.10), $V_1$(Cabbage F1 Hybrid NBH-ARUN) (8.07), $V_{11}$(Cabbage-F1 Lucky Ball) (8.03) which are also statically at par value and minimum was found in $V_6$ F1- Hybrid Cabbage Fieldman which was 7.55 at 90 DAT respectively. Increase of protein content is due to the seed inoculation increased the N content of pods which ultimately reflects TSS content. Also, the higher TSS value is due to the inherent characteristics of the hybrid and is due to favorable influence on various metabolic processes like photosynthesis, respiration, enzyme activity **(Ganie et al., 2013)** which augments the production of metabolites and their translocation to different parts including seed which ultimately increases the concentration of nutrients in seed. The mean TSS Brix of varieties of cabbage was found significant at different stages. Similar findings were found by **Madhuri (2016)** in watermelon.

**Ascorbic Acid (mg/100g):**

The statistically analysed data on days to Ascorbic Acid of cabbage seeds are represented in table 4. It is clear from the table that there is significant difference among various hybrids of cabbage. The maximum Ascorbic Acid (mg/100g) was found in varieties $V_7$ (JK green King F1- Hybrid Seed) which was 29.66 followed by $V_9$ (Hybrid Gayatri) which was 29.25, $V_{12}$ (F1 Hybrid Indam-296) 28.86, $V_5$ (Green Hero) (28.32), $V_3$(Hybrid Cabbage kasha) (28.05), $V_4$(Cabbage NS 22) (27.54) which are also statically at par value and minimum was found in $V_6$ F1- Hybrid Cabbage Fieldman which was 21.03 at 90 DAT respectively. It was probably caused by higher sunlight intensity and also is due to favorable influence on various metabolic processes like photosynthesis, respiration, enzyme activity **(Ganie et al., 2013)** which augments the production of metabolites and their translocation to different parts including seed which ultimately increases the concentration of nutrients in seed and stover. Positive relationship between light and ascorbic acid levelin the plants was also stated. Similar findings were found by **Lee and Kader (2000).** The mean Ascorbic Acid (mg/100g) of varieties of cabbage was found significant at different stages.

**Fiber Content:**

The statistically analysed data on days to Fiber Content of cabbage seeds are represented in table 4. It is clear from the table that there is significant difference among various hybrids of cabbage. The maximum Fiber Content was found in the varieties $V_7$ (JK

green King F1- Hybrid Seed) which was 16.16 followed by $V_9$ (Hybrid Gayatri) which was 15.76, $V_{12}$ (F1 Hybrid Indam-296) 15.73, $V_5$ (Green Hero) (15.69) which are also statically at par value and the minimum Fiber Content was found in $V_6$ F1- Hybrid Cabbage Fieldman which was 9.03. This could be due to favorable influence on various metabolic processes like photosynthesis, respiration, enzyme activity **(Ganie *et al*.,2013)** These significant differences with respect to Fiber content among different varieties is dueto own genetic makeup and the suitability of varieties to the weather conditions of this zone. Similar findings also reported by **El-Bassiony *et al.,* (2014)** in Khol-khol**, Bhangre *et al.,*(2011)** in broccoli.

**Head Equatorial Diameter:**

The statistically analysed data on days to Head Equatorial Diameter of cabbage seeds are represented in table 4. It is clear from the table that there is significant difference among various hybrids of cabbage. The maximum Head Equatorial Diameter was found in the varieties $V_7$ JK green King F1- Hybrid Seedwhich was 10.98 followed by $V_9$ (Hybrid Gayatri) which was 10.87, $V_{12}$ (F1 Hybrid Indam-296) 10.83, $V_5$ (Green Hero) (10.64), $V_3$(Hybrid Cabbage kasha) (10.70), $V_4$(Cabbage NS 22) (10.61), $V_1$(Cabbage F1 Hybrid NBH-ARUN) (10.44), $V_{11}$(Cabbage-F1 Lucky Ball) (10.24), $V_2$(Cabbage F1 Hybrid Royal Vantage) (10.20) which are also statically at par value and the minimum head Equatorial Diameter was found in $V_6$ (F1- Hybrid Cabbage Fieldman) which was 8.41. Increased fruit size attributed in different hybrid genotypes might be due to enhanced photosynthesis, accumulation of carbohydrates and favourable effect on vegetative growth which increased the fruit variety besides increasing the fruit size.This variation might be due to fruit length, number of fruits per plant and effective node. Similar results have been reported **Husnan *et al*. (2013),** and **Mishra *et al* (2019)** in Bottle gourd.

**Head Polar Diameter:**

The statistically analysed data on days to Head polar Diameter of cabbage seeds are represented in table 4. It is clear from the table that there is significant difference among various hybrids of cabbage. The maximum Head Polar Diameter was found in the varieties $V_7$ JK green King F1- Hybrid Seed which was 12.71 followed by $V_9$ (Hybrid Gayatri) which was 12.67, $V_{12}$ (F1 Hybrid Indam-296) 12.21 which are also statically at par value and the minimum head Polar Diameter was found in $V_6$ (F1- Hybrid Cabbage Fieldman) which was 9.16. The diameter of fruits may be due to its hybrid vigour and adoptability to Allahabad agro-climatic conditions. Increased fruit size attributed in different hybrid genotypes might be due to enhanced photosynthesis, accumulation of carbohydrates and favourable effect on vegetative growth which increased the fruit variety besides increasing the fruit size. Similar results have been reported **Husnan *et al*. (2013), Damor *et al* (2016),Kumar *et al* (2018),** and **Mishra *et al* (2019)** in Bottle gourd.

**Head Compactness:**

The statistically analysed data on days to Head Compactness of cabbage seeds are represented in table 4. It is clear from the table that there is significant difference among various hybrids of cabbage. The maximum Head compactness was found in the varieties $V_7$ (JK green King F1- Hybrid Seed) whichwas 37.47 followed by $V_9$ (Hybrid Gayatri) which was 36.17 which are also statically at par value while the minimum head compactness was found in $V_6$ (F1- Hybrid Cabbage Fieldman) which was 29.40. Increased fruit size attributed

in different hybrid genotypes might be due to enhanced photosynthesis, accumulation of carbohydrates and favourable effect on vegetative growth which increased the fruit variety besides increasing the fruit size.This variation might be due to fruit length, number of fruits per plant and effective node.Similar results have been reported **Husnan *et al*. (2013),** and **Mishra *et al* (2019)** in Bottle gourd.

**Table-4. Performance of cabbage varieties in terms of Quality parameters.**

| **Varieties** | **TSS** | **Ascorbic Acid content** | **Fiber content** | **Head compactness** |
|---|---|---|---|---|
| $V_1$ | 8.07 | 26.38 | 13.43 | 32.30 |
| $V_2$ | 7.93 | 26.32 | 12.33 | 30.93 |
| $V_3$ | 8.17 | 28.05 | 15.05 | 33.40 |
| $V_4$ | 8.10 | 27.54 | 14.76 | 32.70 |
| $V_5$ | 8.22 | 28.32 | 15.69 | 34.43 |
| $V_6$ | 7.55 | 21.03 | 9.03 | 29.40 |
| $V_7$ | 8.61 | 29.66 | 16.16 | 37.47 |
| $V_8$ | 7.86 | 21.80 | 11.88 | 30.80 |
| $V_9$ | 8.34 | 29.25 | 15.76 | 36.17 |
| $V_{10}$ | 7.84 | 25.65 | 11.53 | 30.13 |
| $V_{11}$ | 8.03 | 26.34 | 12.8 | 31.80 |
| $V_{12}$ | 8.27 | 28.86 | 15.73 | 35.50 |
| **F test** | **S** | **S** | **S** | **S** |
| **S. Ed (±)** | 0.31 | 1.06 | 0.53 | 0.313 |
| **C.D at 5%** | 4.73 | 4.89 | 4.76 | 1.16 |
| **C.V.** | 0.65 | 2.20 | 1.10 | 0.65 |

**Summary and conclusion:**

The results from my experiment concluded that variety (JK green King F1-Hybrid Seed) found to be best in terms of Growth, Yield and Quality contributing traits along with highest gross return, net return and benefit cost ratio which also gave a significant result for all the characters which were recorded.

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