International Journal of Horticulture, 2024, Vol.14, No.4, 218-222
http://hortherbpublisher.com/index.php/ijh

Research Report Open Access

Performance Evaluation of Cucumber Genotypes and Study on Correlation and Path Analysis

Hari Prasad Ghimire, Namrata Acharya, Rejina Sapkota
Agriculture and Forestry University, Rampur, Chitwan, 44200, Nepal
Corresponding author: ghari9757@gmail.com

International Journal of Horticulture, 2024, Vol.14, No.4 doi: 10.5376/ijh.2024.14.0024
Received: 25 May, 2024
Accepted: 12 Jul., 2024
Published: 12 Aug., 2024

Preferred citation for this article:
Ghimire H.P., Acharya N., and Sapkota R., 2024, Performance evaluation of cucumber genotypes and study on correlation and path analysis, International Journal of Horticulture, 14(4): 218-222 (doi: 10.5376/ijh.2024.14.0024)

Abstract The study was conducted to evaluate the cucumber varieties for different agronomic traits and to study the correlation and heritability traits at Rukum East, Nepal. The experiment was carried out in randomized complete block design (RCBD) with seven cucumber varieties and three replications. Observations were recorded for various growth parameters, floral parameters, and yield parameters. The experimental finding showed the highest plant height (136.66 cm) in Bhaktapur local followed by Garima (104.56 cm). The highest average number of fruits/plants (6) and highest fruit length (23.63 cm) was observed in Bhaktapur local. In the case of yield per plant, the highest yield was observed in Bhaktapur local (2.60 kg) and the lowest in Dynasty (1.34 kg). Among the seven selected varieties the highest yield (26 ton/ha) was obtained from Bhaktapur local and this variety was also preferred by most of the consumers due to its good flavor and taste. Correlation studies revealed that the yield per plot of cucumber was positively correlated and highly significant with yield per plant (1.00***), followed by fruit weight (0.87***), fruit length (0.80***), and plant height (0.74***). Path analysis showed that fruit weight has the highest positive direct effect over fruit yield (0.777) and days to flowering of male flowers and female flowers showed the highest positive indirect effect through fruit weight (0.759). These traits can be considered for crop improvement through selection.

Keywords Cucumber; Correlation; Path analysis; Rukum

1 Introduction

The cucumber is a fruit crop that has significant nutritional, medicinal, and economic value (Ene et al., 2016). It is the fourth most important cultivated vegetable in the world after cabbage, onion, and tomatoes (Ene et al., 2016). In Nepal, cucumber is grown on 9,978 hectares (ha) with productivity of 15.32 mt/ha and production of 152,862 mt (MoALD, 2022). It is cultivated from terai to high hills ranging from 100 masl to 1,800 masl (Khanal et al., 2020). The global production of cucumber was recorded over 91.2 million metric tons from more than 2.2 million hectares of land with a productivity of 40.35 tons/ha (FAOSTAT, 2022). The leading Cucumber producer worldwide is China followed by Turkey, with about one-third of the world's Cucumber produced in China (FAOSTAT, 2022). It's worth noting that the 10 largest world producers of cucumber account for 90.54% of the world's cucumber production Cucumber is one of the potential commodities for export, however, farmers are not getting reasonable prices for many reasons, one being lack of variety recommendation at local level (Dhakal et al., 2023).

Assessment of genetic diversity among genotypes collection could exploit information to enhance the development of better-performing varieties among the cultivated species of cucumber that could be suitable in crop breeding for diverse applications such as identifying diverse parental genotypes. The yield of cucumber in the study area is considerably low due to the non-availability of high-yielding varieties that are well-suited for specific production zones, diseases and pest infestation, fertilizers, irrigation, staking, and drainage (Khanal et al., 2020). Understanding the varietal character of cucumber is essential for maintaining yield and productivity.

Correlation and path analysis studies would be helpful in selecting suitable plant type. Correlation coefficient indicates nature of association among the characters, whereas path analysis splits the correlation coefficients into

measures of direct and indirect effects, thus provide an insight on direct and indirect effect of each character towards yield (Kumar et al., 2018).

This study is designed to search out high-yielding varieties/hybrids suitable for Rukum district and further explore the role of different traits contributing towards the yield of cucumber.

2 Materials and Methods

2.1 Experimental materials

The experiment was carried out from March to July 2023 at Sisne rural municipality-6, East Rukum district. The seeds of seven varieties (Bhaktapur local, Ninja 179, Simran, Raja, Majesty, Dynasty, Garima) were brought from nearby Agrovet. The seeds were sown under protected conditions in each polybag. Soil and organic manure were used for the preparation of growing media. Seedlings were transplanted after three weeks.

2.2 Experimental designs

The experiment was laid out on Randomized Complete Block Design (RCBD). The experiment consisted of seven varieties of cucumber as treatments. The size of the individual plot was maintained at 6 m^2 (2 m×3 m) with plant spacing (100 cm×100 cm). Treatments were replicated three times.

2.3 Data analysis

Plants were observed for different characteristics i.e., plant height, days to flowering of male and female flowers, number of fruits per plant, fruit length, and fruit weight. Data were recorded and coded using MS Excel. The data were analyzed for their mean performance, correlation, and path analysis using R, and results were interpreted accordingly.

3 Results and Discussion

3.1 Mean performance of different traits of cucumber genotypes

The mean plant height of cucumber was 96.07 cm (Table 1) at 45 days after transplanting. The highest plant height was observed in Bhaktapur local (136.66 cm) while the shortest plant height was recorded in Ninja 179 (68.34 cm). The mean days to the first male and female flower after transplanting were 37.51 and 41.57 days respectively. The highest day to the first male and female flower emergence was observed in Bhaktapur local (45 and 52 days, respectively) while the lowest days to the first male and female flower were observed in Simran (34 and 35 days, respectively).

Table 1 Mean comparison of various traits

Treatment	PH (cm)	MF	FF	NFPP	FL (cm)	FW (g)	TNH	YPPN (kg)	YPP (kg)
Garima	104.56^{b}	36^{bc}	40^{bc}	6.00^{b}	20.14^{b}	289.76^{bc}	5.06^{b}	1.74^{b}	10.45^{b}
Simran	98.83^{b}	34^{c}	35^{c}	5.20^{c}	18.77^{bcd}	290.26^{bc}	4.90^{b}	1.50^{bc}	9.05^{bc}
Raja	77.13^{cd}	37^{bc}	43^{b}	4.73^{de}	17.62^{d}	299.16^{bc}	4.67^{bc}	1.42^{c}	8.48^{c}
Dynasty	85.33^{c}	36^{bc}	39^{bc}	4.53^{e}	18.42^{cd}	295.34^{bc}	4.36^{c}	1.34^{c}	8.09^{c}
Ninja 179	68.34^{d}	40^{b}	44^{b}	5.00^{cd}	19.40^{bc}	311.67^{b}	4.70^{bc}	1.55^{bc}	9.35^{bc}
Bhaktapur local	136.66^{a}	45^{a}	52^{a}	5.92^{b}	23.63^{a}	441.00^{a}	5.10^{b}	2.60^{a}	15.65^{a}
Majesty	101.53^{b}	35^{c}	38^{bc}	6.53^{a}	19.61^{bc}	247.50^{c}	5.73^{a}	1.60^{bc}	9.67^{bc}
LSD	10.53^{***}	4.43^{**}	6.15^{**}	0.44^{***}	1.51^{***}	53.33^{***}	3.92^{**}	0.28^{***}	1.69^{***}
SEM (±)	1.29	0.54	0.75	0.05	0.18	6.54	0.07	0.03	0.21
CV %	6.16	6.54	8.26	4.60	4.32	9.65	5.15	9.38	9.38
Grand mean	96.05	37.57	41.57	5.42	19.65	310.67	4.93	1.68	10.11

Note: PH= Plant Height, DFMF= Days to flowering of male flowers, DFFF= Days to flowering of female flowers, NFPP= Number of fruits per plant, FL= Fruit length, FW= Fruit weight, TNH= Total number of harvest, YPPNT= Yield per plant, YPP= Yield per plot, LSD=Least Significant Difference, SEM= Standard Error of Mean, CV=Coefficient of Variation, $**p<0.05$, $***p<0.001$

The mean number of fruits per plant was 5.41. The highest number of fruits per plant was observed in Majesty (6.53) and the lowest number of fruits per plant was observed in Dynasty (4.53) (Table 1). The mean fruit length per plant was 19.65 cm. The highest fruit length was observed in Bhaktapur local (23.63 cm) followed by Garima (21.14 cm) and the lowest fruit length was observed in Raja (17.62 cm). The mean fruit weight per plant was 310.67 gm. The highest fruit weight was observed in Bhaktapur local (441 gm) while the lowest fruit weight was observed in Majesty (247.5 gm).

The effect of varieties on yield in terms of yield per plant and yield per plot among the studied genotypes were found to be significantly different. The mean yield per plant and yield per plot among the genotypes was observed 1.68 and 10.10 respectively. The highest value for yield per plant and yield per plot was observed in Bhaktapur local (2.60 kg and 15.65 kg) respectively while the lowest yield per plant and plot was observed in dynasty (1.34 kg and 8.09 kg) respectively.

3.2 Correlation study among yield and yield contributing characters

The correlation study revealed that the yield per plot of cucumber was positively correlated and highly significant with yield per plant (1.00, $p<0.001$), followed by fruit weight (0.87, $p<0.001$), fruit length (0.80, $p<0.001$), plant height (0.74, $p<0.001$) days to flowering of female flower (0.72, $p<0.001$), days to flowering of male flower (0.71, $p<0.001$) and fruit circumference (0.67, $p<0.001$) (Figure 1). This indicates that the yield of cucumber can be subsequently improved with the improvement in these traits. Similar findings were reported by Bhaiya et al. (2020) in days to flowering of male and female flowers. Nandi et al. (2019) also reported a positive correlation of fruit weight and fruit length with yield. Moreover, the number of fruits per plant was found to be positively but weakly correlated (0.52, $p<0.05$) with yield per plot while the total number of harvests was found to be non-significant. The total number of harvests was found to be non-significant for all other traits signaling that no other traits, including crop yield, can be improved by changing TNOH.

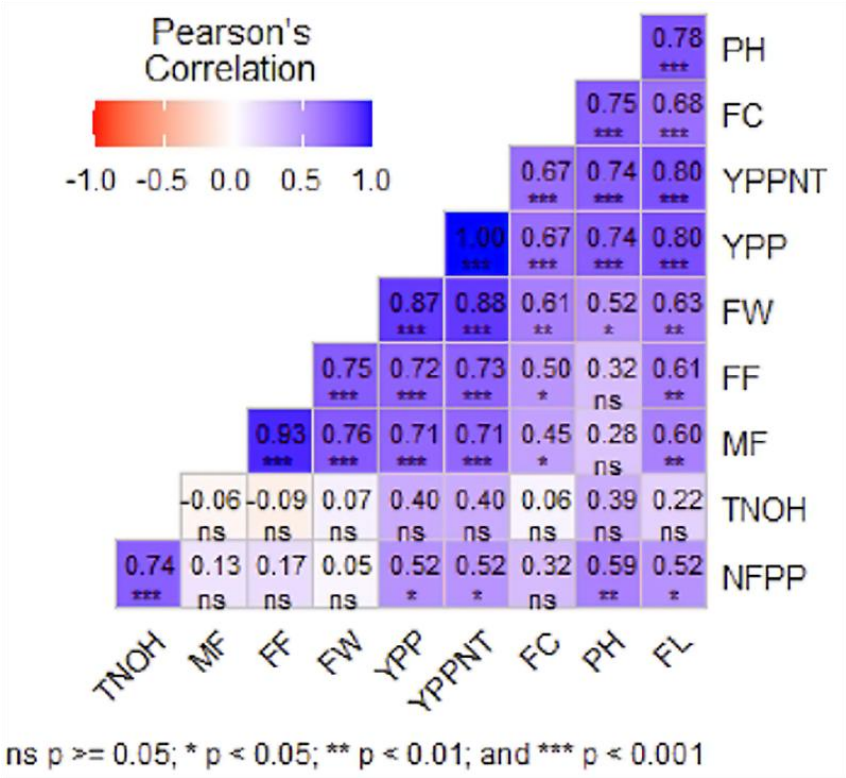

Figure 1 Correlation between various yield parameters

Note: FC= Fruit Circumference, FF= Days to flowering of female flowers, FL= Fruit length, FW= Fruit weight, PH= Plant height, MF= Days to flowering of male flowers, NFPP= Number of fruits per plant, TNOH= Total number of harvest, YPPNT= Yield per plant, YPP= Yield per plot

3.3 Path analysis study

The path coefficient analysis techniques involves a method of partitioning the total correlation between the dependent variable and the independent component variable to show the direct and indirect effect. The direct effect directly enhances yield, but the indirect effect influences yield through other traits. The data on path coefficient analysis at the genotypic level shows the direct and indirect effects of significant traits over fruit yield per plot (Table 2). From the data, it is known that fruit weight has highest positive direct effect over fruit yield (0.777), followed by number of fruits per panicle (0.424), plant height (0.180), days to flowering of female flowers (0.076) and total number of harvest (0.011). These traits are directly involved in the high yield of cucumber. Positive direct effect of fruit length, fruit weight, and number of fruits per plant on yield was also reported by Hossain et al. (2010) and Dhiman and Chander (2005). Positive direct effects of average fruit weight on yield were also reported by Kumar et al. (2008). Similarly, fruit circumference (-0.078) shows the most negative direct effect on yield per plot followed by fruit length (-0.051) and days to flowering of male flower (-0.008). These traits can be considered responsible for directly lowering the yield of cucumber. The highest positive indirect effect was found for days to flowering of male flowers and female flowers through fruit weight (0.759). While the highest negative indirect effect was found for plant height through fruit circumference (-0.076). At the genotypic level, the residual effect was found 0.0012.

Selection of the traits having direct and indirect positive effect on yield aids to the improvement in total yield of cucumber because they are directly or indirectly involved in increasing the total yield.

Table 2 Path coefficient analysis showing direct (bold) and indirect effects of various traits on yield per plot

	PH	MF	FF	FL	FC	FW	NFPP	TNOH
PH	**0.180**	-0.003	0.037	-0.045	-0.076	0.518	0.286	0.006
MF	0.077	**-0.008**	0.078	-0.041	-0.046	0.759	0.019	0.0002
FF	0.087	-0.008	**0.076**	-0.042	-0.052	0.759	0.028	0.0005
FL	0.161	-0.006	0.062	**-0.051**	-0.071	0.704	0.260	0.006
FC	0.174	-0.005	0.050	-0.046	**-0.078**	0.608	0.169	0.002
FW	0.120	-0.008	0.074	-0.046	-0.061	**0.777**	0.016	-0.002
NFPP	0.122	-0.0003	0.004	-0.031	-0.031	0.029	**0.424**	0.012
TNOH	0.104	-0.0002	0.004	-0.027	-0.021	-0.181	0.471	**0.011**

Note: Residual: 0.0012; FC= Fruit Circumference, FF= Days to flowering of female flowers, FL= Fruit length, FW= Fruit weight, PH= Plant height, MF= Days to flowering of male flowers, NFPP= Number of fruits per plant, TNOH= Total number of harvest

4 Conclusion

The experimental findings showed that among the seven varieties used for the experiment, Bhaktapur local was found superior in terms of various traits including fruit yield. Thus, this variety should be selected for cultivation in Rukum East. The correlation study revealed that the yield per plot of cucumber was positively correlated and highly significant with yield per plant followed by fruit weight, fruit length and plant height. These traits ultimately affect the yield of cucumber.

Further, Path analysis showed that the fruit weight directly influences the yield of cucumber, and the days to flowering of male flowers and female flowers indirectly influence the fruit yield. Thus, from the correlation studies it is concluded that selection should be made based on higher average fruit weight, fruit length, and plant height to bring desired improvement in the yield of cucumber.

Authors' contributions

HPG completed the writing of the original draft, conducted investigations, conceptualized the study, developed the methodology, and carried out data collection and analysis. NA conducted investigations, conceptualized the study, collected data, and performed writing, review, and editing. RS participated in the methodology, performed validation, conducted formal analysis, and carried out writing, review, and editing. All authors read and approved the final manuscript.

Conflict of Interest Disclosure

The authors affirm that this research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

References

Bhaiya R., Singh V.B., Yadav G.C., Kumar Y., and Tiwari D., 2020, Character association and path coefficient analysis of growth, yield, and its contributing traits in cucumber (*Cucumis sativus* L.), International Journal of Chemical Studies, 8(5): 431-433. https://doi.org/10.22271/chemi.2020.v8.i5f.10337

Dhakal T., Khanal B., and Maharjan S., 2023, Performance of exotic cucumber varieties under local cultivation practices in Kapilvastu district of Nepal. International Journal of Environment, Agriculture and Biotechnology, 8(5): 67-73. https://doi.org/10.22161/ijeab.85.11

Dhiman M.R., and Chander Parkash C.P., 2005, Correlation and path coefficient analysis in cucumber, Haryana Journal of Horticultural Science, pp.111-112.

Ene C.O., Ogbonna P.E., Agbo C.U., and Chukwudi U.P., 2016, Studies of phenotypic and genotypic variation in sixteen cucumber genotypes, Chilean Journal of Agricultural Research, 76(3): 307-313. https://doi.org/10.4067/S0718-58392016000300007

FAOSTAT, 2022, Food and Agriculture Organization of the United Nations.

Hossain M.F., Rabbani M.G., Hakim M.A., Amanullah A.S.M., and Ashanullah A.S.M., 2010, Study on variability character association and yield performance of cucumber (*Cucumis sativus* L.), Bangladesh Res. Pub, 4(3): 297-311.

Khanal S., Shrestha J., and Lamichhane J., 2020, Economics of production and marketing of cucumber in Nawalpur district of Nepal, Azarian Journal of Agriculture, 7(3): 93-101. https://doi.org/10.52547/azarinj.034

Kumar P., Syed S., Lakshmi M., Reddy S., and Reddy S., 2018, Studies on correlation and path-coefficient analysis for yield and its contributing characters in cucumber (*Cucumis sativus* L.), International Journal of Chemical Studies, 6(6): 1649-1653.

Kumar A., Kumar S., and Pal A.K., 2008, Genetic variability and characters association for fruit yield and yield traits in cucumber, Indian journal of horticulture, 65(4): 423-428.

MoALD, 2022, Annual Statistical Information on Nepalese Agriculture, Ministry of Agriculture and Livestock Development, https://moald.gov.np.

Nandi S., Thapa U., Banerjee S., and Mondal R., 2019, Character association and path analysis for fruit yield and it's contributing traits in cucumber genotypes (*Cucumis sativus* L.) under naturally ventilated polyhouse during off season, Journal of Pharmacognosy and Phytochemistry, 8(6): 2439-2442.