Original Research Article

Path analysis in bitter gourd (*Momordicacharantia*) hybrids

Comment [ma1]: Need to be revised base on aims

ABSTRACT:The present ~~investigation~~research was conducted ~~carried out~~ using 16 different ~~bitter gourd~~ hybrids of bitter gourd to study path coefficients of various ~~yield~~ yield-contributing ~~characters~~ traits and was conducted in the Department of Horticulture, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, Puducherry, India.The ~~study~~ results ~~revealed~~ showed that the length of the ~~character~~ vine ~~length~~ at final harvest (10.3228)had ~~shown~~the ~~maximum positive~~greatest direct positive effect ~~towards~~ on the fruit yield of vine^{-1}, ~~followed~~ and then~~by~~ the days ~~to~~ until the first fruit harvest (5.2426), flesh thickness (1.7492), the node ~~bearing~~ with the first female flower (1.7188) and the number of primary branches of vine^{-1} ~~at~~ in the final harvest (0.5681) and ~~hence~~thus ~~suggesting~~ showed the importance of these traits in ~~exercising~~ choosing ~~selection for~~ a desirable ~~genotype of~~ bittergourd genotype.

Comment [ma2]: Need to be completed with the treatments, replications, statistical method, studied parameters, ...

Comment [ma3]:

Key words: Bitter gourd, Path coefficient, Selection, Direct and indirect effect.

INTRODUCTION

Comment [ma4]: Need to be complete in the references of this study

Vegetables are being the vital component of a well-balanced diet.India is the world's second-largest producer of vegetables, with a total area under cultivation of 10.10 million hectares and a production of 185.88 million t. (National Horticultural Board Statistics, 2018-19).Bitter gourd is considered as one of the important commercial cucurbits, belonging to the Cucurbitaceaefamily (Heiser, 1979). Crop improvement through selection is the preliminary approach still followed in the development of any crop and fixing the right choice of traits to decide upon selection of a favourable genotype decides the success of the crop improvement programme.Path coefficient analysis being an efficient tool in elucidating the direct and indirect effect of each character towards yield, it would give an idea about the actual contribution of each

independent character on dependent character, the yield. The study of path analysis of various characters determining yield on bitter gourdis presented here.

MATERIALS AND METHODS

Comment [ma5]: Need to be complete in the name of hybrids and statistical method, studied parameters,... the method of measurement in studied parameters

The research was carried out in Karaikal, UT of Puducherry, India, at the Department of Horticulture of Pandit Jawaharlal Nehru College of Agriculture and Research Center during Rabi Summer 2021. The material consists of 16 distinct hybrids of bitter gourds from different parts of the nation. Three replications of the experiment were set up using a Randomized Block Design. Observations were made on five plants from each replication in each hybrid on various growth and yield-contributing characters and the data was analysed in accordance with Dewey and Lu's (1959) recommendations to divide the genotypic correlation coefficient of component traits with fruit yield vine^{-1} into direct and indirect effects.

RESULT AND DISCUSSION

The study of direct and indirect effects of characters is made possible by path coefficient analysis, which also quantifies their proportional contribution to yield, which was done at the genotypic level to differentiate the direct and indirect impacts of various traits on fruit yield vine^{-1}.

From Table 1it is observed that the Maximum positive direct effect on fruit yield vine^{-1} was exerted by vine length at final harvest (10.3228), followed by days to first fruit harvest (5.2426), flesh thickness (1.7492), node bearing first female flower (1.7188) and number of primary branches vine^{-1} at final harvest (0.5681). Similar findings have been reported by Kumari*et al*. (2018) for vine length at final harvest and node bearing first female flower, Jatav*et al*. (2016) for days to first fruit harvest, Gupta *et al*. (2015) for number of primary branches vine^{-1} at final harvest and Rani *et al*. (2015) for flesh thickness in bitter gourd.

The direct effect exerted on yield by days to first male flower anthesis (-1.3135), fruit girth (-1.5097), days to final harvest (-2.5227), number of fruits vine^{-1} (-3.8875), weight of individual fruit (-4.3676), fruit length (-4.4258), days to first female flower anthesis (-6.2070) and node bearing first male flower (-8.1273) were found negative. Such reports had been given earlier by Islam *et al*. (2009) for fruit girth, fruit length and days to first female flower

anthesisand by Kumari*et al*. (2018) for number of fruits vine^{-1} and days to final harvest and by Tiwari *et al*. (2021) for days to first male flower anthesis,weight of individualfruit and node bearing first male flower.

Table 1. Direct and indirect effects of various characters on yield of bitter gourd hybrids

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	r_g with yield
X_1	**-1.3135**	-5.4520	-0.4620	-0.2759	4.2812	0.6905	-0.5671	0.3704	-0.2731	0.6365	0.2078	1.2749	0.8634	-0.019
X_2	-1.1536	**-6.2070**	0.2754	0.1115	3.9970	-0.3622	-0.5787	0.9925	-1.2998	0.8298	0.1926	2.3501	0.8878	0.035
X_3	-0.0747	0.2103	**-8.1273**	0.5083	-1.2483	1.9782	0.4630	1.1494	1.8571	-0.3540	-0.1978	5.4289	-2.0305	-0.437**
X_4	0.2108	-0.4027	-2.4036	**1.7188**	-1.1947	0.8412	0.2882	2.6777	0.5983	-0.2828	-0.3513	-0.9946	-1.1311	-0.426**
X_5	-1.0725	-4.7323	1.9352	-0.3917	**5.2426**	-1.2405	-0.2667	0.5112	-1.0794	0.7686	0.2787	-1.1750	1.3916	0.170
X_6	0.2049	-0.5080	3.6327	-0.3267	1.4694	**-4.4258**	-0.1688	-0.0302	-3.3374	0.8276	0.3034	1.7169	1.2121	0.570**
X_7	-0.4934	-2.3795	2.4923	-0.3281	0.9262	-0.4947	**-1.5097**	-1.0696	-2.7723	1.0509	0.2856	3.3952	1.4718	0.575**
X_8	0.1251	1.5847	2.4030	-1.1839	-0.6895	-0.0343	-0.4154	**-3.8875**	0.1663	-0.1182	0.2536	1.8307	0.4808	0.515**
X_9	-0.0821	-1.8472	3.4558	-0.2355	1.2956	-3.3819	-0.9583	0.1481	**-4.3676**	1.2857	0.3459	3.4453	1.4789	0.583**
X_{10}	-0.4779	-2.9446	1.6447	-0.2779	2.3035	-2.0940	-0.9070	0.2628	-3.2103	**1.7492**	0.2426	2.9018	1.2585	0.451**
X_{11}	-0.4805	-2.1040	2.8301	-1.0628	2.5722	-2.3639	-0.7591	-1.7354	-2.6597	0.7470	**0.5681**	3.6072	1.4493	0.609**
X_{12}	-0.1622	-1.4131	-4.2743	-0.1656	-0.5967	-0.7361	-0.4966	-0.6894	-1.4577	0.4917	0.1985	**10.3228**	-0.7301	0.291*
X_{13}	0.4495	2.1844	-6.5416	0.7706	-2.8920	2.1265	0.8808	0.7409	2.5604	-0.8726	-0.3264	2.9874	**-2.5227**	-0.455**

Bold figure indicates direct effects

Residual effect = 0.36417

r_g - Genotypic correlation with yield

X_1 - Days to first male flower anthesis (explain all in material and methods) X_2- Days to first female flower anthesis X_3- Node bearing first male flower X_4 - Node bearing first female flower X_5- Days to first fruit harvest X_6- Fruit length (cm) X_7 - Fruit girth (cm) X_8- Number of fruits vine^{-1} X_9- Weight of individual fruit (g) X_{10} - Flesh thickness (mm) X_{11}- Number of primary branches vine^{-1} at final harvest X_{12} -Vine length at final harvest (m) X_{13} - Days to final harvest

The highest positive indirect effect on yield through vine length at final harvest was exerted by node bearing first male flower (5.4289) and similar findings have been reported by Sowmya*et al*. (2019), followed by days to first fruit harvest through days to first male flower anthesis (4.2812) as well as through days to first female flower anthesis (3.9970) which was in conformity with the earlier findings of Tiwari *et al*. (2021).

The highest negative indirect effect on yield through node bearing first male flower was exerted by days to final harvest (-6.5416), followed by days to first female flower anthesis through days to first male flower anthesis (-5.4520) and days to first female flower anthesis through days to first fruit harvest (-4.7323) and all these were similar to the findings of Tiwari *et al*. (2021).

Conclusion

Path analysis revealed the highest positive direct effect of vine length at final harvest, days to first fruit harvest and node bearing first female flower on fruit yield vine^{-1}, while the highest negative direct effect was observed fornode bearing first male flower, days to first female flower anthesis and fruit length. These traits should be well considered which exercising selection for higher yield in bitter gourd.

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