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Path analysis for fodder yield and quality in horsegram

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Abstract
Path coefficient analysis splits the correlation coefficients into direct and indirect effects of the component characters on yield based on which crop improvement can be done more effectively. Correlation between yield and any of its component trait is due to its direct effect, which states a true relationship exists between them. Selection can be practised for such characters in order to improve yield. But if the correlation is mainly due to indirect effect of the character through another component character, then the selection is done in the later character through which the indirect effect is exerted. The present investigation was carried out in college of Agriculture, Vellayani during August 2021 to December 2021 with the objective to evaluate the character association horsegram for its fodder quality and yield. The study revealed that the residual effects obtained were 0.102 and 0.11 which indicated 89.9 per cent and 89.0 per cent of the variation in green fodder yield plant^{-1} and dry fodder yield plant^{-1} were respectively contributed by the characters taken in the present analysis.

Keywords: Fodder yield, horsegram, *Macrotyloma uniflorum*

Introduction
Horse gram a potential human food supplement as researched in many ways is scientifically known as *Macrotyloma uniflorum* (Lam.) Verdcort but their fodder characteristics were least explored. Horsegram is drought tolerant leguminous crop and has immense fodder value like any other legumes. Fourteen characters were evaluated and their direct and indirect effects were studied. Selection of various characters contributing to green fodder yield plant^{-1} and dry fodder yield plant^{-1} and their direct and indirect contribution is essential and is attained through path analysis.

Materials and Methods
The present experiment was conducted to study the path coefficient analysis in forty genotypes of horsegram in a Randomized Block Design with three replications from August 2021 to Feb 2021 at College of Agriculture, Vellayani. The observations analysed were plant height at harvest, number of primary branches plant^{-1}, number of leaves plant^{-1}, days to first flowering, days to fifty per cent flowering, leaf area index, green fodder yield plant^{-1}, dry fodder yield plant^{-1}, leaf fresh weight plant^{-1}, leaf dry weight plant^{-1}, stem fresh weight plant^{-1}, stem dry weight plant^{-1}, crude protein content and crude fibre content.
Path coefficient analysis is a standardized partial regression coefficient measures the direct influence of one variable upon another and permits the separation of the correlation coefficients into components of direct and indirect effects (Dewey and Lu, 1959) [2]. This method permits the breeder to identify relatively important components of a variable, on the basis of their direct and indirect influences.
The direct and indirect effects both at genotypic and phenotypic level were estimated by taking grain yield per plant as dependent variable using path coefficient analysis suggested by Dewey and Lu (1959) [2].

$r_{1y} = P_{1y} r_{11} + P_{2y} r_{12} + P_{3y} r_{13}$ ……+ $P_{ny} r_{1n}$
$r_{2y} = P_{1y} r_{21} + P_{2y} r_{22} + P_{3y} r_{23}$ ……+ $P_{ny} r_{2n}$
$r_{ny} = P_{1y} r_{n1} + P_{2y} r_{n2} + P_{3y} r_{n3}$ ……+ $P_{ny} r_{3n}$

Where;
1, 2 ……..n = Independent variables
y = Dependent variable

r_{1y}, r_{2y} …….. r_{ny} =Coefficient of correlation between casual factors `1` to `n` on dependent character 1
P_{1y}, P_{2y} …… P_{ny} = Direct effect of character 1 to n on character Y

Results and Discussion

Path coefficient analysis helps in the estimation of direct effects and indirect effects of the related characters on a dependant variable *viz*., yield. Path diagrams for green fodder yield plant^{-1} and dry fodder yield plant^{-1} and are considered as the dependent variable for the path analysis. For the dependant variable green fodder yield plant^{-1}, the component characters chosen were plant height at harvest (cm), number of primary branches plant^{-1}, number of leaves plant^{-1}, leaf area index, leaf fresh weight plant^{-1} and stem fresh weight plant^{-1} (Table 1). Similarly for the dependant variable dry fodder yield plant^{-1}, the component characters selected were, number of primary branches plant^{-1}, number of leaves plant^{-1}, leaf area index, leaf dry weight plant^{-1}, stem dry weight plant^{-1} (Table 2).

Table 1: Direct and indirect effects of green fodder yield components in horsegram

	Plant height at harvest (cm)	**Number of primary branches plant^{-1}**	**Number of leaves plant^{-1}**	**Leaf Area Index**	**Leaf fresh weight plant^{-1} (kg)**	**Stem fresh weight plant^{-1} (kg)**	**Total genotypic correlation**
Plant height at harvest (cm)	0.112	-0.071	0.147	0.148	-0.22	0.135	0.251
Number of Primary branches plant^{-1}	0.171	0.238	-0.195	-0.168	0.102	0.142	0.29
Number of leaves plant^{-1}	0.109	-0.111	0.107	0.763	-0.217	-0.214	0.437
Leaf Area Index	0.024	0.004	0.236	0.245	0.193	-0.234	0.468
Leaf fresh weight Plant^{-1}(g)	-0.313	0.232	0.182	0.285	0.451	-0.189	0.648
Stem fresh weight Plant^{-1}(g)	-0.008	0.214	0.052	0.052	0.083	0.327	0.72

Residual effect=0.102
The diagonal values given in bold indicate the direct effects of green fodder yield components in horsegram

Table 2: Direct and indirect effects of dry fodder yield components in horsegram

	Number of Primary branches plant^{-1}	**Number of leaves plant^{-1}**	**Leaf Area Index**	**Leaf dry weight plant^{-1} (kg)**	**Stem dry weight plant^{-1} (kg)**	**Total genotypic correlation**
Number of Primary branches plant^{-1}	0.283	0.166	-0.105	-0.167	0.111	0.288
Number of leaves plant^{-1}	-0.144	0.125	0.205	-0.102	0.234	0.318
Leaf Area Index	0.108	0.255	0.367	-0.025	0.253	0.958
Leaf dry weight Plant^{-1}(kg)	-0.007	0.233	0.179	0.228	-0.011	0.622
Stem dry weight Plant^{-1}(kg)	0.111	0.158	0.353	-0.23	0.223	0.615

Residual effect=0.11
The diagonal values given in bold indicate the direct effects of dry fodder yield components in horsegram

Path diagram representing the direct and indirect effects of the component characters on green fodder yield plant^{-1} is provided in Fig. 1. The maximum direct effect on green fodder yield plant^{-1} was shown by leaf fresh weight plant^{-1} (0.410), followed by stem fresh weight plant^{-1} (0.327), leaf area index (0.245), number of primary branches plant^{-1}(0.238), number of leaves plant^{-1} (0.107), and plant height at harvest (0.112). Significant direct effect as well as indirect effects on green fodder yield plant^{-1} was marked by stem fresh weight plant^{-1} (0.722), leaf fresh weight plant^{-1} (0.648), leaf area index (0.468), and number of leaves plant^{-1} (0.438). Leaf area index recorded the maximum positive indirect effects through number of leaves plant^{-1} (0.763) on green fodder yield plant^{-1}. The residual effect obtained was 0.102 and indicated that 89.8 per cent of the variation in green fodder yield plant^{-1} was contributed by the characters selected for analysis.

Path diagram representing the direct and indirect effects of the component characters on dry fodder yield plant^{-1} is provided in Fig. 2. Direct effect for dry fodder yield plant^{-1} was maximum for leaf area index, followed by number of primary branches plant^{-1}, leaf dry weight plant^{-1}, stem dry weight plant^{-1} and number of leaves plant^{-1}. Significant direct effect as well as indirect effects on dry fodder yield plant^{-1} was marked by leaf area index (0.958), leaf dry weight plant^{-1} (0.622), stem dry weight plant^{-1} (0.615) and number of leaves plant^{-1} (0.318). Stem dry weight plant^{-1} recorded the highest positive indirect effect through leaf area index (0.353) on dry fodder yield plant^{-1}. The residual effect obtained was 0.11 and indicated that 89.0 per cent of the variation in dry fodder yield plant^{-1} was contributed by the characters taken in the present analysis.

Similar results were obtained by Radhika (2003), Nath and Tajne (2014), Sunil *et al*. (2017) [4, 3, 6] in cowpea and Christy (2019) [1] in fodder horsegram.

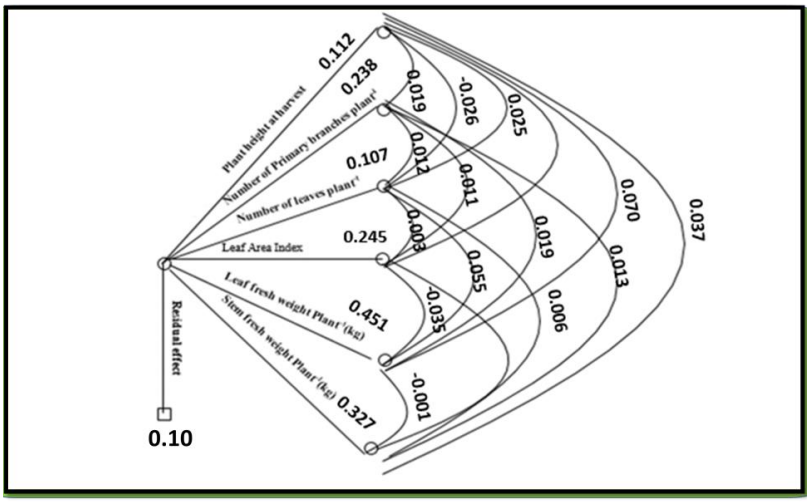

Fig 1: Direct and indirect effects of green fodder yield components in horsegram

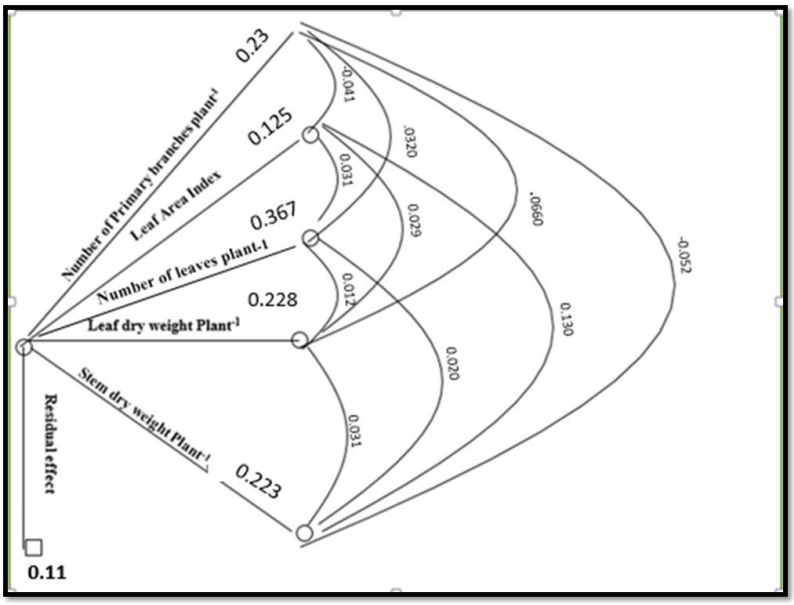

Fig 2: Direct and indirect effects of dry fodder yield components in horsegram

Conclusion

Path coefficient analysis helps in the estimation of direct effects and indirect effects of the related characters on a dependant variable *viz*., yield. Path diagrams for green fodder yield plant^{-1} and dry fodder yield plant^{-1} and are considered as the dependent variable for the path analysis. The study revealed that the residual effects obtained were 0.102 and 0.11 which indicated 89.9 per cent and 89.0 per cent of the variation in green fodder yield plant^{-1} and dry fodder yield plant^{-1} were respectively contributed by the characters taken in the present analysis.

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