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CORRELATION COEFFICIENT STUDIES IN ASHWAGANDHA (*Withania somnifera* Dunal) cv. JAWAHAR-20

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ABSTARCT: In an experiment conducted on ashwagandha (*Withania somnifera* Dunal), to study the response of different organic amendments with organic manure (FYM) and bio-fertilizers in relation to plant growth, root yield and quality parameters. It was found that the seedlings (5-7 leaf stage) inoculated with *Azospirillum* @ 10^5 or 10^6 CFU resulted a significant increase in plant growth and biomass yield which exhibited a positive association among them in contributing the root yield and quality traits. The maximum and positive correlation (0.884) was observed between the total alkaloid and withanaloid content followed by fresh root weight per plant (g) and fresh root yield per ha (0.831) and between plant height and number of leaves per plant (0.777). The association of the plant height also exhibited a highly significant correlation with stem diameter (0.659), alkaloid (0.777) and withanaloid (0.668) content in the roots. The number of leaves per plant had highly significant and positive correlation (1.99) with plant canopy followed by alkaloid (0.755) and withanaloid (0.774) contents. The fresh root weight per plant exerted the positive and significant effect of high magnitude (0.831) and fresh root yield (kg) per plot. Dry root weight per plant could established a significant and positive association (0.514) with dry root yield (kg) per ha. The total alkaloid content in the roots witnessed a highly significant and positive correlation with plant height (0.777), number of leaves per plant (0.755) followed by positive and significant association with stem diameter (0.573), number of berries per plant (0.554) and fresh root yield (kg) per plot (0.485). Withanaloid content (%) witnessed a highly significant and positive correlation with plant height (0.668), number of leaves per plant (0.754) and alkaloid content (0.884). Whereas a significant and positive correlation exhibited with stem diameter (0.581).

Keywords: *Withania, correlation, root yield, alkaloid and withanaloid.*

Ashwagandha is a perennial shrub and grows naturally under subtropical dry climate in well drained, sandy loam or light red soils having ph of 7.5 to 8.0 with an average rainfall of 600-750 mm. It is been grown on large scale in dry part of the country as a medicinal plant, especially on marginal lands in several districts of Madhya Pradesh, covering an area of more than 4000 hectares (Nigam, 4) and its cultivation has extended in recent years, to Kota in Rajasthan, foot-hills of Punjab and Himachal Pradesh and Tarai regions of Uttarakhand and Uttar Pradesh. Commercial cultivation, being on priority for high returns needs a sustained and agronomic package for production of economically safe raw material for pharmaceutical industry on large scale. Owing to the increased demand for organic and safe products of ashwagandha roots, leaves and seeds used in formulation of various *Ayurvedic* and *Unani* medicines, there is prudent need to cultivate this crop by safe application of bio-organic nutrition from vermi-compost and FYM along with a beneficial free-living soil bacteria usually applied as plant growth promoting *Rhizobacteria* or PGPR in the formulation as strains of *Azospirillum*, which lives in close association of plant roots and enhance plant growth by its ability to fix atmospheric nitrogen, production of indole acetic acid, siderophore, nitrate and single molecules resulting in an increased mineral uptake in the plant roots as suggested by Bashan and Holguin (1).

Therefore, the development of a reliable tool to establish an association resulting through a symbiotic association as beneficial biological model between them and dependent plant growth

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characters on root and root quality traits in future agricultural production as studied by Misra *et al*. (3). Therefore, the present experiment was conducted to see and evaluate a response of bio-organic nutrition through a application of FYM, Vermi-compost and *Azospirillum* in Ashwagandha (*Withania somnifera* Dunal.) and an association of plant growth, seed, root yield and quality parameters was worked out to establish a relationship as a response and feasibility of safe and bio-organic application in cultivation of this medicinal plant for commerce.

MATERIALS AND METHODS

The present experiment was carried out at the experimental fields of Ch. Shivnath Singh Shandilya P.G. College, Machhra, Meerut (U.P) during the two consecutive years viz. 2005-06 and 2006-07 on perennial crop of Ashwagandha (*Withania somnifera*) cv. Jawahar-20 under the field conditions using of FYM (Farm Yard Manure), Vermi-compost and *Azospirillum.* The experiment was laid out in the factorial RBD replicated thrice. Bio-organic nutrition was applied to beds in experimental field in combinations, comprising of FYM, viz. 0 kg/plot (F_0), 2 kg/plot (F_1) or 3 kg/plot (F_3) and Vermi-compost 0 kg/plot (V_0), 2 kg/plot (V_1) or 3 kg/plot (V_2) and *Azospirillum* 0 CFU/plot (AZ_0). The chemical analysis was done in the laboratory of Medicinal and Plants under Council of Scientific and Industrial Research (CSIR), New Delhi. The average data for I year, II year were pooled and analyzed for ANOVA and interactions among the treatments as per the methods suggested by Panse and Sukhatme (5). Further, genotypic association of all the yield contributing characters with root yield and quality was worked out as path coefficient analysis suggested by Dewey and Lu (2).

RESULTS AND DISCUSSION

The correlations existed between the plant growth, root yield and quality components (Table 1) were analysed to study the association among them revealed that a strong association was exhibited. The maximum and positive correlation (0.884) was observed between the total alkaloid and withanaloid content followed by fresh root weight per plant (g) and fresh root yield per ha (0.831) and between plant height and number of leaves per plant (0.777). The association of the plant height also exhibited a highly significant correlation with stem diameter (0.659), alkaloid (0.777) and withanaloid (0.668) content in the roots. However, a significant value of coefficients was also recorded with number of berries per plant (0.500) and fresh root yield (kg) per plot. The stem diameter had significant and positive correlation with plant canopy (0.507), fresh root weight per plant (0.525), alkaloid (0.573) and withanaloid (0.581) content. The number of leaves per plant had highly significant and positive correlation (1.99) with plant canopy followed by alkaloid (0.755) and withanaloid (0.774) contents and significant correlation with number of berries per plant (0.549) and fresh root yield (0.593) per plot. The number of branches per plant witnessed positive and significant correlation with leaf area (0.511), dry root per plant (0.486), dry weight per plant (0.479) and fresh (0.481) and dry root yield per kg/ha (0.513). Plant canopy exhibited positive and significant correlation (0.542) with a single character, namely fresh root weight per plant where as the other coefficients among them were moderate and of low magnitude. The individual leaf area exhibited a significant and positive correlation with fresh (0.530) and dry (0.492) weight of roots per plant. Number of berries per plant witnessed positive and highly significant (0.705) correlation with fresh root yield per kg per plot followed by a significant and positive association with alkaloid content (0.554) in the roots.

The number of primary roots per plant exhibited a significant and positive association (0.580) with secondary root length per plant. The fresh root weight per plant exerted the positive and significant effect of high magnitude (0.831) and fresh root yield (kg) per plot. Dry root weight per plant could established a significant and positive association (0.514) with dry root yield (kg) per ha.

Table 1: Correlation coefficients among the plant growth, yield and quality components in ashwagandha as influenced by different bio fertilizer treatments.

S. No.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	0.65**	0.777**	0.347	0.126	0.122	0.500*	-0.223	-0.111	0.037	0.079	0.134	0.284	0.120	0.456*	-0.053	0.153	0.331	0.427	0.777**	0.668**
2	—	0.410	0.402	0.507*	0.347	0.322	0.178	-0.045	0.110	0.271	0.267	0.525*	0.158	0.246	0.024	0.338	0.271	0.354	0.573*	0.581*
3		—	-0.007	1.99 **	-0.064	0.549*	-0.321	-0.028	-0.103	-0.142	0.070	-0.003	0.083	0.593*	-0.089	-0.171	0.243	0.231	0.755**	0.754**
4			—-	0.224	0.511*	0.169	-0.015	-0.112	0.071	`0.296	-0.159	0.486*	0.479*	-0.006	-0.048	0.481*	0.513*	0.241	0.225	0.155
5				—	0.308	-0.007	0.179	0.260	0.186	0.315	0.132	0.542*	0.174	0.183	0.142	0.462	-0.134	0.105	-0.008	0.098
6					—-	0.043	0.175	0.296	0.354	-0.090	0.228	0.530*	0.492*	0.153	0.386	0.272	0.206	0.038	0.043	0.082
7						—-	-0.308	0.046	0.237	-0.185	0.260	0.034	0.105	0.705**	-0.137	-0.058	0.332	0.193	0.554*	0.409
8							—-	0.276	-0.317	0.177	0.088	0.276	0.091	0.002	0.417	0.272	0.057	-0.145	-0.113	-0.025
9								—-	0.057	0.007	0.352	0.324	0.142	0.200	0.081	0.116	0.002	0.015	0.069	0.028
10									—-	-0.039	0.580*	0.073	0.254	0.053	0.004	0.048	0.038	0.121	-0.071	-0.266
11										—-	0.272	0.212	0.174	-0.282	-0.096	0.307	0.455	0.144	0.045	0.019
12											—	0.096	0.188	0.163	0.205	0.042	0.329	0.195	0.202	0.045
13												—-	0.349	0.254	0.110	0.831**	0.177	0.386	0.164	0.148
14													—-	0.104	0.244	0.171	0.514*	-0.301	0.008	0.015
15														—-	0.231	0.177	0.175	0.076	0.485*	0.455
16															—	0.048	0.160	-0.379	-0.256	-0.072
17																—-	0.151	0.443	0.079	0.013
18																	—-	0.139	0.277	0.265
19																		—-	0.418	0.229
20																			—-	0.884**

* = 0.470 and **= 0.639 (the values denoted by * are significant and by ** are highly significant at P = 0.05)

1. Plant height (cm)
2. Stem diameter (cm)
3. Number of leaves/plant
4. Number of branches/plant
5. Plant canopy (cm^2)
6. Leaf area (cm^2)
7. Number of berries/plant.
8. Number of seeds/berry
9. Main root length (cm)
10. Number of primary roots
11. Number of secondary root/plant
12. Secondary root length (cm)
13. Fresh root weight per plant (g)
14. Dry root weight (g)/plant
15. Fresh root yield (Kg)/plot
16. Dry root yield (Kg)/plot
17. Fresh root yield (Kg)/ha
18. Dry root yield (Kg)/ha
19. Fresh & Dry root weight ratio
20. Total Alkaloid Content (%)
21. Withanaloid content

The maximum and positive correlation (0.884) was observed between the total alkaloid and withanaloid content followed by fresh root weight per plant (g) and fresh root yield per ha (0.831) and between plant height and number of leaves per plant (0.777). The association of the plant height also exhibited a highly significant correlation with stem diameter (0.659), alkaloid (0.777) and withanaloid (0.668) content in the roots. The number of leaves per plant had highly significant and positive correlation (1.99) with plant canopy followed by alkaloid (0.755) and withanaloid (0.774) contents. The fresh root weight per plant exerted the positive and significant effect of high magnitude (0.831) and fresh root yield (kg) per plot. Dry root weight per plant could established a significant and positive association (0.514) with dry root yield (kg) per ha. The total alkaloid content in the roots witnessed a highly significant and positive correlation with plant height (0.777), number of leaves per plant (0.755) followed by positive and significant association with stem diameter (0.573), number of berries per plant (0.554) and fresh root yield (kg) per plot (0.485). Withanaloid content (%) witnessed a highly significant and positive correlation with plant height (0.668), number of leaves per plant (0.754) and alkaloid content (0.884). Whereas a significant and positive correlation exhibited with stem diameter (0.581).These findings are in close conformity with by Singh *et al*. (6).

The association between independent characters in respect to the fresh root yield, alkaloid and withanolid content co-existed in a significant and positive association except with a few of them but exhibiting a relationship of a very low magnitude. Number of seeds/berry, number of primary roots and dry root yield per plot had negative correlation (-0.025, -0.266 and -0.073 respectively) with a very low magnitude among them. However the other negative and positive correlations observed and recorded between various characters were of very low magnitude indicated that an application of bio-fertilizers *vis a vis* an increased dose has improved the fresh root yield and quality parameter in ashwagandha var. Jawhar-20 employed in the present investigation. The dry root yield and chemicals estimated witnessed strong and positive relationship among them but a negative with biomass in fresh weight of plant and spread of the plant canopy with a lower magnitude. However, a positive association with strong and significant magnitude was established for plant growth components namely; stem diameter (cm), leaf area (cm^2) and main root length per plant. These findings were in pace with those reported by Misra *et al.* (3).

REFERENCES

1. Bashan, Y. and Holguin, G. (1997). *Azospirillum* plant relations environmental and physiological advances (1990-1996). *Can. J. Microbiol.,* **43:** 103-121.
2. Dewey, D.R. and Lu (1959). A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J.* **51:** 515-518.
3. Misra, H.O., Sharma, J.R., Lal, R.K. and Sharma, S. (1998). Genetic variability and path analysis in asgandh (*Withania somnifera*). *J. Medi. and Arom. Plant Sci.,* **20:** 753-756.
4. Nigam, K.B., Rawat, G.B. and Prasad, Bhagwat (1984). Effect of methods of sowing, plant density and fertility level on ashwagandha (*Withania somnifera* Dunal). *South Indian Hort.*, **32**(6): 356-359.
5. Panse, V.G. and Sukhatme, P.V. (1979). Genetics and quantitative characters in relations to plant breeding. *Indian J. Genet.,* **17**: 318-328.
6. Singh, A.K., Singh, H.P., Singh, S.P., Kalra, A. (2008). Genetic variability and correlation studies for selection criteria in Safed Musli (*Chlorophytum borivilianum*, Santapau). *Communi. Biometry and Crop Sci.,* **3** (2): 67–71.