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RESEARCH ARTICLE

CHARACTER ASSOCIATION AND PATH COEFFICIENT ANALYSIS IN KHARIF ONION (*allium cepa* L.)

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Abstract

Correlation study indicated that bulb yield had significant and positive correlation with plant height volume of bulb, bulb weight, equatorial bulb diameter, neck thickness, dry matter content and nitrogen in leaves and had significant negative correlation with number of doubles bulb. Path analysis showed that phosphorous in leaves followed by bulb and neck thickness had highest positive direct effect on bulb yield. On the basis of present study it may be concluded that the bulb weight, polar bulb diameter, neck thickness and volume of bulb should be given due weight age while making selection for desirable genotypes.

INTRODUCTION

Onion (Allium cepa L.) is one of the most important bulb crops, grown widely all over the world and consumed in various forms. Mature bulbs are used as vegetable, spice, pickles in brine/vinegar, soups and sauces purposes and also dehydrated and used as powder for seasoning other dishes. The green leaves and immature/mature bulbs are eaten as raw or used in preparation of vegetables. Besides, onion has been known for its high medicinal properties for centuries. Yield is a complex character and it depends on a number of characters, thus yield can be improved by direct as well as indirect selection. To identify component character, correlation is considered as an important tool. In order to collect information on association of different characters and their direct and indirect influence on bulb yield as the basic requirement for improvement, the present investigation was undertaken.

MATERIALS AND METHODS

The present investigation consisting of 24 genotypes of kharif onion received from Directorate of Onion and Garlic Research, Pune (MH) as part of AINPROG trial. The materials were grown in a randomized block design with three replications at Department of Vegetable Science, College of Horticulture & Forestry, Jhalawar during kharif season 2009. Individual genotype was planted in 3mX 2m size plot at 15 X 10 cm spacing. Required agronomical practices were followed to raise a healthy crop. The observations were recorded on plant height, number of leaves per plant, bolting, volume of bulb, bulb weight, polar bulb-diameter, equatorial bulb diameter, neck thickness, bulb yield, number of doubles bulb, number of fleshy scale leaves, total soluble solids, dry matter content, pungency, nutrient contents (N, P, K, S, Zn, Cu, Fe) in leaves and bulb. The correlation coefficient was calculated as per the method suggested by Singh and Choudhary (1985). Path coefficient analysis was done according to Dewey and Lu (1959).

RESULTS AND DISCUSSION

The treatment differences for all the characters except plant height under study were significant indicating the presence of sufficient variability among the genotypes. The correlation results (Table 1) indicated that bulb yield had significant positive correlation with bulb weight, polar bulb diameter and copper content in bulb at genotypic level and with plant height, volume of bulb, bulb weight, equatorial bulb diameter, neck thickness, number of doubles bulb and pungency at phenotypic level indicating that bulb yield was largely function of these traits. These finding are in conformity to the earlier works done by researchers (Netrapal et al. 1988; Gurjar and Singhania, 2006). Correlation between number of doubles bulb and bulb yield was significant but negative which indicated that genotype having lesser number of double bulbs are high yielding ones.

Among other traits, positive and significant association of plant height with neck thickness, pungency, Zinc and copper content in bulb; number of leaves per plant with bulb weight and TSS; bolting with number of doubles bulb; volume of bulb with bulb weight, polar bulb diameter, equatorial bulb diameter and copper in leaves; bulb weight with polar bulb diameter, equatorial bulb diameter and volume of bulb; polar bulb diameter with equatorial bulb diameter and bulb weight; equatorial bulb diameter with dry matter content, nitrogen in bulb; nitrogen in leaves with potassium in bulb; phosphorus in leaves with iron in leaves and phosphorus in bulb; sulphur in leaves with sulphur in bulb; zinc in leaves with zinc in bulb; copper in leaves with volume of bulb; iron in leaves with phosphorus in bulb and phosphorus in leaves ; nitrogen in bulb with sulphur in bulb and TSS, phosphorus in bulb with phosphorus in leaves and iron in leaves; sulphur in bulb with sulphur in leaves and nitrogen in bulb; zinc in bulb with copper in bulb and zinc in leaves; copper in bulb with zinc in bulb and iron in bulb with number of doubles bulb were recorded. Similar findings were reported by Padda et al. (1973), Haydar et al. (2007) in onion and Kallo et al. (1982).

Path coefficient analysis (Table 2) revealed that the character like phosphorus in leaves (3.95), sulphur in bulb (1.11), pungency (1.01), dry matter content (0.95), Zinc in leaves (0.84), iron in bulb (0.84), volume of bulb (0.65) and neck thickness (0.60) exercised maximum direct effect on bulb yield, indicating these traits are of great importance for yield improvement. These results were in conformity to Suthanthira Pandian and Muthukrishnan (1982), Gurjar and Singhania (2006), Haydar et al. (2007) and Aliyu et al (2007).

Thus on the basis of present study it may be concluded that the bulb characters like weight, polar diameter, neck thickness and volume of bulb may be of merit value when making selection for desirable genotypes.

Table 1: Genotypic and Phenotypic correlation coefficient between bulb yield and other Characters in kharif onion

S. No.	Characters	Genotypic correlation coefficient	Phenotypic correlation coefficient
1	Plant height (cm)	0.12	0.88**
2	Number of leaves per plant	0.0	0.29
3	Bolting (%)	0.30	-0.35
4	Volume of bulb (cc)	-0.35	0.47*
5	Bulb weight (gm)	0.82**	0.59**
6	Polar bulb diameter(cm)	0.47*	1.09
7	Equatorial bulb diameter (cm)	0.29	0.82**
8	Neck thickness (mm)	0.04	0.74**
9	Number of doubles bulb (%)	-0.11	-0.42*
10	Number of fleshy scale leaves	-0.21	0.10
11	TSS (%)	0.12	0.29
12	Pungency (µmol/g)	0.31	0.51**
13	Dry matter content (%)	-0.13	0.15
14	N in leaves (%)	0.06	0.46
15	P in leaves (%)	-0.02	0.16
16	K in leaves (%)	0.02	0.09
17	S in leaves (%)	0.25	0.18
18	Zn in leaves (ppm)	-0.31	-0.19
19	Cu in leaves (ppm)	0.23	-0.23
20	Fe in leaves (ppm)	0.40	-0.28
21	N in bulb (%)	0.00	0.23
22	P in bulb (%)	0.30	0.08

23	K in bulb (%)	-0.21	0.04
24	S in bulb (%)	-0.22	-0.02
25	Zn in bulb (ppm)	-0.03	0.19
26	Cu in bulb (ppm)	0.65**	0.12

Table 2: Estimates of direct and indirect effects at phenotypic (P) and genotypic (G) in kharif onion

Character	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20	X21	X22	X23	X24	X25	X26	X27	X28	R
X2	**-0.12**	-0.01	0.32	0.07	0.00	-0.02	0.16	0.38	-0.24	0.01	0.04	-0.06	0.95	0.12	-0.49	0.02	0.05	0.02	-0.01	0.08	-0.31	0.27	-0.33	-0.02	0.24	-0.05	-0.18	0.88**
X3	0.01	**0.23**	-0.37	-0.14	0.04	-0.07	-0.18	0.04	-0.09	0.02	-0.10	0.21	0.05	0.08	0.12	0.02	-0.00	0.27	-0.00	-0.18	-0.15	0.18	0.02	0.30	0.07	-0.01	-0.35	0.29
X4	0.04	0.08	**-1.02**	-0.25	-0.02	0.28	0.02	-0.06	-0.29	-0.02	0.06	-0.10	-0.08	-0.07	-0.99	0.02	0.02	0.25	-0.02	0.71	0.18	0.66	0.15	0.29	-0.03	-0.00	-0.16	-0.35
X5	-0.01	0.05	0.39	**0.65**	0.07	-0.39	-0.29	0.19	0.25	-0.02	-0.01	0.02	0.13	0.13	-1.01	0.02	-0.06	-0.01	0.02	0.07	0.26	0.95	-0.15	-0.47	-0.04	0.02	-0.14	-0.47*
X6	-0.00	0.10	0.24	0.58	**0.08**	-0.51	-0.34	0.16	0.28	0.00	0.00	0.17	-0.09	0.13	-0.62	0.02	-0.02	-0.08	0.02	0.01	0.24	0.79	-0.07	-0.19	-0.05	0.02	-0.26	0.59**
X7	-0.00	0.03	0.47	0.41	0.07	**-0.60**	-0.25	0.09	0.38	0.02	-0.01	0.15	0.17	0.14	0.37	0.02	-0.06	-0.13	0.02	0.00	0.23	0.21	-0.26	-0.35	0.03	-0.02	-0.02	1.09
X8	0.04	0.08	0.03	0.36	0.05	-0.29	**-0.53**	-0.01	0.23	0.01	-0.06	0.48	-0.08	0.16	-0.81	0.02	0.06	-0.06	0.01	0.34	0.22	0.55	-0.11	0.20	-0.07	0.02	-0.03	0.82**
X9	-0.08	0.01	0.10	0.21	0.02	-0.09	0.01	**0.60**	0.09	0.02	0.02	-0.07	0.17	-0.01	-1.09	0.02	-0.03	0.10	-0.01	0.64	-0.14	0.97	-0.15	-0.29	0.02	-0.00	-0.30	0.74**
X10	-0.05	0.03	-0.48	-0.26	-0.04	0.37	0.19	-0.09	**-0.62**	-0.03	0.03	-0.49	0.20	-0.07	-0.89	0.02	0.04	0.27	-0.01	0.54	0.01	0.66	0.30	0.21	0.10	-0.01	-0.37	0.42*
X11	-0.01	0.04	0.17	-0.11	0.00	-0.08	-0.05	0.10	0.14	**0.12**	-0.04	0.26	-0.11	-0.13	0.18	0.02	0.04	-0.06	0.00	-0.59	-0.17	-0.18	0.26	0.27	0.04	-0.00	0.03	0.10
X12	0.02	0.09	0.23	0.03	-0.00	-0.02	-0.13	-0.05	0.07	0.02	**-0.25**	0.36	-0.02	0.05	0.51	0.02	-0.02	-0.08	-0.00	0.02	-0.45	-0.35	-0.05	0.13	0.09	-0.00	0.10	0.29
X13	0.01	0.05	0.11	0.01	0.02	-0.09	-0.27	-0.05	0.32	0.03	-0.10	**0.95**	-0.15	0.06	0.68	0.02	0.03	-0.33	-0.01	-0.48	-0.10	-0.50	-0.23	0.24	-0.03	-0.00	0.34	0.51*
X14	-0.11	0.01	0.08	0.09	-0.01	-0.10	0.04	0.10	-0.12	-0.01	0.01	-0.14	**1.01**	0.03	-0.67	0.02	-0.00	-0.05	0.00	0.27	-0.02	0.36	-0.34	-0.21	0.03	-0.02	-0.08	0.15
X15	-0.04	0.05	0.20	0.24	0.03	-0.24	-0.24	-0.01	0.12	-0.04	-0.03	0.15	0.09	**0.36**	-0.03	0.02	-0.02	0.07	0.00	0.37	-0.07	0.15	-0.43	-0.10	0.05	-0.01	-0.16	0.46*
X16	0.02	0.01	0.25	-0.17	-0.01	-0.06	0.11	-0.16	0.14	0.01	-0.03	0.16	-0.17	-0.00	**3.95**	0.02	-0.03	-0.02	0.00	-1.56	-0.22	-2.73	0.21	0.18	0.04	-0.01	0.24	0.16
X17	-1.10	2.06	-9.17	5.84	0.75	-5.44	-4.75	5.37	-5.56	1.04	-2.27	8.52	9.08	3.23	35.59	**0.00**	2.36	7.59	0.44	-21.2	-7.85	-25.9	-9.08	9.98	2.50	-0.49	7.55	9.00
X18	-0.03	-0.00	-0.07	-0.16	-0.01	0.14	-0.12	-0.06	-0.10	0.02	0.02	0.11	-0.02	-0.02	-0.38	0.02	**0.26**	-0.26	-0.01	0.55	-0.34	-0.15	0.07	0.97	-0.06	0.01	-0.20	0.18
X19	-0.00	0.07	-0.31	-0.01	-0.01	0.09	0.04	0.07	-0.20	-0.01	0.02	-0.37	-0.06	0.03	-0.09	0.02	-0.08	**0.84**	0.01	-0.57	-0.04	0.29	0.34	-0.18	0.12	-0.01	-0.19	-0.19
X20	0.02	-0.00	0.37	0.33	0.03	-0.21	-0.07	-0.10	0.19	0.00	0.01	-0.16	0.07	0.01	0.19	0.02	-0.05	0.19	**0.05**	-0.95	0.07	-0.33	0.21	-0.20	0.02	0.01	0.05	-0.23
X21	0.00	0.02	0.31	0.02	-0.00	0.00	0.08	0.16	0.14	0.03	0.00	0.19	-0.12	-0.06	2.61	0.02	-0.06	0.20	0.02	**-2.36**	-0.00	-1.77	0.38	-0.01	0.03	-0.01	0.24	-0.28
X22	-0.04	0.04	0.21	-0.19	-0.02	0.16	0.13	0.10	0.01	0.02	-0.13	0.11	0.03	0.03	1.01	0.02	0.10	0.04	-0.00	-0.01	**-0.87**	-0.87	-0.03	0.49	0.09	-0.00	-0.18	0.23
X23	0.01	-0.01	0.23	-0.21	-0.02	0.04	0.10	-0.20	0.14	0.01	-0.03	0.17	-0.13	-0.02	3.76	0.02	0.01	-0.08	0.01	-1.45	-0.26	**-2.88**	0.21	0.34	0.02	-0.01	0.33	0.08
X24	-0.04	-0.00	0.15	0.10	0.01	-0.16	-0.06	0.09	0.19	-0.03	-0.01	0.22	0.34	0.15	-0.83	0.02	-0.02	-0.28	-0.01	0.88	-0.03	0.60	**-1.01**	-0.24	-0.03	-0.01	0.05	0.04
X25	0.00	0.06	-0.27	-0.28	-0.01	0.19	-0.09	-0.16	-0.12	0.03	-0.03	0.21	-0.19	-0.03	0.65	0.02	0.23	-0.14	-0.01	0.03	-0.39	-0.87	0.22	**1.11**	-0.01	0.00	-0.17	-0.02
X26	-0.10	0.06	0.09	-0.10	-0.02	-0.07	0.13	0.04	-0.22	0.02	-0.08	-0.12	0.12	0.07	0.56	0.02	-0.06	0.36	0.00	-0.24	-0.27	-0.26	0.11	-0.03	**0.28**	-0.04	-0.05	0.19
X27	-0.11	0.03	-0.03	-0.21	-0.02	-0.21	0.16	0.03	-0.07	0.01	-0.00	0.04	0.31	0.04	1.05	0.02	-0.05	0.15	-0.01	-0.30	-0.04	-0.65	-0.25	-0.01	0.18	**-0.05**	0.13	0.12
X28	0.03	-0.10	0.19	-0.11	-0.03	0.01	0.02	-0.21	0.27	0.00	-0.03	0.38	-0.10	-0.07	1.14	0.02	-0.06	-0.19	0.00	-0.66	0.18	-1.12	-0.06	-0.22	-0.02	-0.01	**0.84**	0.10

Residual Effect: 1.82

X2=	Plant height (cm)	X11=	Number of fleshy scale leaves	X20=	Copper in leaves (ppm)
X3=	Number of leaves per plant	X12=	TSS (%)	X21=	Iron in leaves (ppm)
X4=	Bolting (%)	X13=	Dry matter content (%)	X22=	Nitrogen in bulb (%)
X5=	Volume of bulb (cc)	X14=	Pungency(µmol)	X23=	Phosphorus in bulb (%)
X6=	Bulb weight (gm)	X15=	Nitrogen in leaves (%)	X24=	Potassium in bulb (%)
X7=	Polar bulb diameter(cm)	X16=	Phosphorus in leaves (%)	X25=	Sulphur in bulb (%)
X8=	Equatorial bulb diameter (cm)	X17=	Potassium in leaves (%)	X26=	Zinc in bulb (ppm)
X9=	Neck thickness (mm)	X18=	Sulphur in leaves (%)	X27=	Copper in bulb (ppm)
X10=	Number of doubles bulb (%)	X19=	Zinc in leaves (ppm)	X28=	Iron in bulb (ppm)

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