References

Arnon, D.I. (1949). Copper enzymes in isolated chloroplasts, polyphenol oxidase in *beta vulgaris*. *Plant Physiol.* 24: 1-15.

Bates, L.R., Waldren, R.P. and Teare, I.D. (1973). A rapid determination of free proline for water stress studies. *Pl. Soil.* 39: 205-207.

Bernstein, L. and Hayward, H.E. (1958). Physiology of salt tolerance. *Ann. Rev. Plant Physiol.* 9: 25-46.

Chopra, S.L. and Kanwar, J.S. (1991). Analytical agricultural chemistry, Kalyani Publishers, New Delhi, pp.514.

Gill, K.S. and Sharma, P.C. (1999). Response of salinity stress in Brassica and recovery from stress damage at early growth stages. *Cult.* 65: 111-112.

Glenn, E.P., Brown, J.J. and O'Leary, J.W. (19 Irrigating crops with sea water. *Scient American*, 71: 56-61.

Sharma, D.A. (1980). Effect of using saline wa to supplement canal water irrigation on c growth of rice. *Curr. Agric.* 4: 57-60.

Somani, L.L. (1991). Crop production with sal water. Agro botanical publisher, pp.30

Wrag, J.L. and Filner, P. (1970). Structural a functional relationship of enzyme activit induced by nitrate in barley. *Biochem.* 5: 817-829.

(Received : July 2002; Revised : January 20

Madras Agric. J. 90 (1-3) : 190-193 January-March 2003

Research Notes

Genotypic and Phenotypic correlation and path analysis studies Karonda (*Carissa carandas* L.)

R.B. SAWANT, T.A. MORE, S.A. RANPISE AND S.V. SANWANT
Department of Horticulture, College of Agriculture, Kolhapur, Maharastra

Karonda (*Carissa carandas* L.) is important dry land fruit crop exceedingly hardy shrub generally found in forest. The genus Carissa to which Karonda belongs includes 32 species out of which only eight are originated from India and according to Cooke (1904) Carissa is more useful amongst all. The existing population of this crop shows the variability in plant and fruit characters due to heterozygosity (Bhagwat, 1984; Joshi *et al.* 1986) and this offers great scope for crop improvement for this crop. In selection process and crop improvement knowledge of association of various characters is primary requisite. In the present investigation, the studies were taken with objectives to study the association between ten different morpho physical characters of Karonda which will helpful for further improvement in Karonda.

The normally growing 212 genotypes selected from the ten villages of six Tahsils in hills of sub-mountain region of Kolhapur district were evaluated for growth, yield and qualit parameters during 1992 and 1993 and wer taken for the present investigation to asse the association between fourteen importa characters as indicated in Table 1. The genotypi and phenotypic correlation coefficient wer calculated for the different pairs of character The correlation coefficients between differen characters were estimated at genotypic an phenotypic levels following Johnson *et al.* (1956) while path analysis was calculated by metho suggested by Dewey and Lu (1959) takin fruit weight as dependant.

It was revealed from the Table 1 tha the magni-tude of level of significance of genotypic correlation coefficients and phenotypic correlation coefficients were more or less same for all the characters. Therefore, the results obtained only on correlation coefficient at phenotypic levels are described hereunder.

Characters		Fruit	Seed wt. per fruit	Wt.of individual seed	Seed. No. per fruit	T.S.S.	Moisture	Juice	Reducing sugar	Fruits per branch	Fruit weight
Fruit diameter	P	0.921**	0.448**	0.477**	-0.014	-0.434**	0.327**	-0.067	-0.064	-0.191**	0.913**
	G	0.959**	0.526**	0.858**	-0.078	-0.473**	0.365**	-0.086	-0.069	-0.203**	0.957**
Fruit length	P		0.416**	0.503**	-0.040	-0.399**	0.282**	-0.074	-0.050	-0.19**	0.890**
	G		0.490**	0.860**	-0.099	-0.430**	0.312**	-0.115	-0.054	-0.248**	0.935**
Pomace	P		0.469**	0.528**	-0.182**	-0.473**	0.264**	-0.271**	-0.050	-0.197**	0.959**
	G		0.525**	0.859**	-0.245**	-0.500**	0.286**	-0.322**	-0.051	-0.200**	0.983**
Seed wt./ fruit	P			0.321**	0.008	-0.239**	0.135**	-0.135**	0.059	-0.168**	0.469**
	G			0.503**	0.000	-0.270**	0.138**	-0.185**	0.066	-0.188**	0.530**
Wt.of individual seed	P				-0.085	-0.252**	0.140**	-0.150**	0.058	-0.063	0.530**
	G				-0.101	-0.234**	0.233**	-0.150**	0.094	-0.089	0.862**
Seed No.	P					-0.159**	0.089**	0.87	0.002	0.072	-0.144**
	G					-0.247**	0.128**	0.102	0.000	0.085	-0.213**
T.S.S.	P						-0.247**	0.142**	0.145**	0.059	-0.455**
	G						-0.271**	0.250**	0.151**	0.061	-0.476**
Moisture	P							0.917**	-0.226**	0.039	-0.108**
	G							0.054	-0.250**	0.049	-0.182
Juice	p								0.053	0.039	-0.108**
	G								0.87	0.049	-0.182
Acidity	P								0.005	-0.133	0.006
	G								0.005	-0.134	0.006
Reducing sugar	P									-0.016	-0.039
	G									-0.016	-0.043
Non reducing sugar	P									0.022	-0.007
	G									0.023	-0.007
Fruit No.	P										-0.198**
	G										-0.201**

P = Phenotypic ; G = Genotypic

Table 2. Path analysis studies in Karonda

Character	Direct effect on fruit weight	Fruit diameter	Fruit length	Seed wt. per fruit	Weight of individual seed	Seed number	T.S.S.	Moisture	Juice	Reducing sugar	Fruits per branch
Fruit diameter	0.349	0.007	0.700	-0.076	0.002	-0.009	-0.009	-0.007	-0.014	-0.000	0.957
Fruit length	0.007	0.335	0.693	-0.076	0.002	-0.008	-0.008	-0.010	-0.000	-0.000	0.935
Pomace	0.774	0.316	0.006	-0.076	0.006	-0.010	-0.007	-0.027	-0.000	0.000	0.983
Seed wt./ fruit	0.010	0.184	0.003	-0.045	-0.000	-0.005	-0.003	-0.016	-0.001	-0.000	0.530
Wt.of individual seeds	-0.089	0.300	0.006	0.005	0.002	-0.008	-0.006	-0.013	-0.000	-0.000	0.862
Seed No.	-0.023	-0.027	0.001	0.000	0.003	0.003	0.017	-0.001	-0.000	0.000	-0.213
T.S.S.	-0.020	-0.165	-0.003	-0.003	0.039	-0.006	0.007	-0.021	-0.001	0.000	-0.476
Moisture	-0.024	0.127	0.002	0.001	-0.021	-0.003	-0.005	0.005	0.001	-0.000	0.300
Juice	0.084	-0.030	-0.001	-0.002	0.013	-0.005	0.005	-0.001	0.001	-0.000	-0.182
Acidity	-0.013	0.020	0.000	0.001	-0.003	-0.002	0.001	0.001	-0.009	0.000	0.006
Reducing sugar	0.013	-0.024	-0.000	-0.001	-0.008	-0.000	0.003	0.006	0.007	-0.000	-0.043
Non-reducing sugar	0.001	-0.015	0.000	0.000	0.003	-0.000	0.000	0.001	-0.006	0.000	-0.007
Fruit No.	0.014	-0.072	-0.001	-0.002	0.008	-0.002	0.001	0.002	0.004	0.002	-0.201

* Values of path analysis are at genotypic level.

The fruit weight w significantly and positive associated with fruit diameter, fr length, pomace content, seed weig per fruit and weight of sing seed and negative with seed numb TSS, moisture percentage and fr number. They exhibited a negati correlation between fruit numb and fruit diameter, fruit lengt pomace and seed weight per fr (Table 1). Fruit diameter a fruit length were significantly a positively correlated with poma seed weight per fruit, weight single seed, moisture percenta and fruit weight with T percentage and fruit number th were associated in negati direction. While, TSS content w negatively associated with fr diameter, fruit length, seed wei per fruit and it was positiv associated with juice percenta and reducing sugar. Reducing sug was significantly and positivel associated with TSS content bu it was negatively associated wit the moisture content. This indicat that if selection was made fo any of these components, th simulations selection for othe characters will be achieved. Thi helps to avoid complexities o selection procedures. The earlie findings of Dhumal *et al.* (1993 and Ranpise and Desai (1994 in acid lime were similar to th results of present investigatio The association between pomac acidity and non-reducing suga with fruit weight are non significa and of low magnitude.

Direct and indirect pat effects, both at phenotypic an genotypic levels, taking fruit weigh as dependent characters wer calculated and was revealed tha the pomace, fruit diameter, frui length, seed weight per fruit an

ght of seed exerted the maximum indirect ct via fruit number on the fruit weight vice-versa (Table 2). The results of direct indirect effects at genotypic levels also wed the similar trend at phenotyic levels. nace content and fruit diameter exerted imum direct effect on fruit weight at genotypic l. The fruit diameter, fruit length, pomace ent, weight of individual seed and seed fruit influenced the fruit weight via-fruit ber at genotypic level, while direct and rect effects of other characters on fruit ght were of very low magnitude. The direct ct on such characters on fruit weight was observed by Sena *et al.* (1993) in Cashewnut. the basis of correlation and path analysis, an be concluded that the selection based fruit diameter and fruit length and pomace ent of individual fruit would be helpful he selection of best types in Karonda.

erences

gwat, N.R. (1984). Studies on flowering and fruiting in Karonda (*Carissa carandas* L.) M.Sc. (Agri.) Thesis, Konkan Krishi Vidhyapeeth, Dapoli, India.

Cooke, C.T. (1904). Flora of precidancy of Bombay, Vol-II, Botanical survey of India, Calcutta: 186.

Dewey, D.R. and Lu, R.H. (1959). A correlation and path analysis. Components of crested wheat grass seed production. *Agron. J.* 515-518.

Dhumal, S.A., Patil, S.D. and Jadha, M.G. (1993) Studies on variability and correlation analysis in fruit characters in Karonda. *J. Maharastra Agri. Univ.* **18**: 498-99.

Johnson, H.W., Robinson, H.T. and Comstock, R.E. (1956). Genotypic and phenotypic correlation in soyabean and their implication in selection. *Agron. J.* **47**: 477-483.

Joshi, G.D., Prabhudesai, V.G. and Salve, M.G. (1986). Physico-chemical characters of Karonda (*Carissa carandas* L.). *Maharashtra J. Hort.* **3**: 39-44.

Ranpise, S.A. and Desai, U.T. (1994). Genotypic and phenotypic correlation in acid lime. *South Indian Hort.* **42**: 133-136.

Sena, D.K., Lenka, P.C., Jagadev, P.N. and Baura Sashikala (1994). Genetic variability in association in cashew nut. *India J. Genet.* **54**: 304-309.

(Received : June 2002; Revised : February 2003)

Madras Agric. J. 90 (1-3) : 193-194 January-March 2003

Research Notes

ortification of tomato seeds to augment seedling vigour

GEETHARANI, A. VIJAYAKUMAR, S. SUNDERESWARAN AND T. THANGARAJ
rticultural College and Research Institute, Periyakulam - 625 604, Tamil Nadu.

The increase in seed yield indicates the pe for further rationalizing the nutrients for cient production pattern at various stages growth and flower production for obtaining gher seed yield.

Among the popular vegetables, tomato *ycopersicon esculentum*), ranks first with respect food value and taste. Tomato is graded perior because of its higher contents of vitamin B, C and calcium. The production of tomato is been hampered severely due to lack of ality seeds and proper soil management and prevalence of disease infestation. Thus, an attempt was made to improve the seedling vigour through fortification with micronutrients may result in a good field emergence and pave way for harvesting higher yield.

Fresh seeds of tomato PKM-1 were fortified using optimum quantity of water as well as nutrient solutions at 1:1 ratio on weight/volume basis for 16 hours under room temperature. The chemicals used were combination of sodium dihydrogen phosphate (0.5%) and potassium orthophosphate (0.5%) in 1:1 proportion on