Journal of Dryland Agriculture
ISSN: 2476 - 8650

Isa et al., 2017: 3(1). p 94 - 98

Correlation and Contribution of Some Growth and Yield Components to Fruit Yield of Tomato (*Solanum lycopersicon* L.)

*H. M. Isa., A. A. Manga and M. A. Hussaini

Department of Agronomy, Bayero University, Kano, Nigeria
*correspondence: hmisa.agr@buk.edu.ng

Abstract

Interrelationships among tomato yield and yield components for moisture stressed tomato in most of Sub-Saharan Africa through foliar sprayed Antitranspirants using path-coefficient analysis that describes a cause-and-effect relationship have not been documented. In view of this, a field experiment was conducted during the two successive dry seasons of 2011/2012 and 2012/2013 at the Teaching and Research Farm of Faculty of Agriculture, Bayero University, Kano. The treatments consisted of two Antitranspirants (Salicylic acid and Benzoic acid) at four concentrations each (0, 200, 400 and 600 ppm) and three moisture stress stages (vegetative, flowering and fruit setting). Antitranspirants and moisture stress constituted the main plots and concentrations were used as sub–plot treatments which were laid out in a spilt-plot design and replicated three times. Significant and positive correlation was observed between number of fruits per plant and average fruit weight. Path-analysis revealed that number of fruits per plant had the highest direct contribution to fruit yield. The highest indirect effect was observed from plant height and number of fruits per plant and also from number of branches per plant and number of fruits per plant at the two locations. Based on this findings selection on characters such as plant height, number of branches per plant, number of fruits per plant and average fruit weight could be useful towards improvement of fruit yield of tomato.

Keywords: path- analysis, correlation, tomato and fruit yield

Journal of Dryland Agriculture
ISSN: 2476 - 8650

Introduction

Tomato (*Solanum lycopersicon* l.) belongs to the family *Solanaceae* (also known as the night shade family). It is currently the most important commercial vegetable grown in Northern Nigeria during the dry season. Tomato is a rich source of vitamin A, B and C with acidic properties that bring out other flavours (Rakesh and Adarsh, 2010). In recent decades the consumption of tomatoes has been associated with the prevention of several diseases (Wilcox *et al.,* 2003, Sharoni and Levi, 2006) mainly due to the content of antioxidants including carotenes, ascorbic acid and phenolic compounds (Periago *et al.,* 2009). Despite these benefits and an increase in output of tomato production with corresponding land area, FAO (2012) stated that the yield level in Nigeria is low when compared to major producing countries like Ethiopia and Niger with average yield of 7.1 t ha^{-1}. Therefore, to achieve increased production by increasing the yield potential of the crop, knowledge of the direction and magnitude of association between the growth, yield and yield related traits is essential.

One of the ways in achieving this is to identify characters that significantly affect yield. Correlation analysis measures the relationship between various plant characters and determines the component characters on which selection could be used for improvement in yield (Mahmud *et al.,* 1997). The direction and magnitude of correlation has been studied by many researchers and found to be different. A correlation study helps to identify traits that are associated. Path coefficient analysis depicts nature and extent of correlation whether direct or indirect towards yield (Manga *et al.,* 2005). The advantage of path analysis is that it permits the partitioning of the correlation coefficient into its components, one component being the path coefficient that measures the direct effect of a predictor variable upon its response variable; the second component being the indirect effect (s) of a predictor variable on the response variable through another predictor variable.

Materials and Methods

The experiment was conducted in successive dry seasons of 2011/2012 and 2012/2013 at the Teaching and Research Farm of Faculty of Agriculture Bayero University, Kano (11° 97′ 98.6″ N, 8° 42′ 03.7″ E 475 m above sea level). The treatments consisted of two antitranspirants (Benzoic and Salicylic acids) at four concentrations each (0, 200, 400 and 600 ppm) and three moisture stress stages (vegetative, flowering and fruit setting). These were arranged in a split-plot design and replicated three times. The gross plot size was 3.6m x 3.0m (10.8m^2) consisting of 6 rows of 3m length, while the net plot size was 1.2 m x 1.8 m (2.16 m^2) consisting of 2 inner most rows.

The experimental site was ploughed, harrowed and prepared into plots of slightly sunken beds. Paired rows of beds were separated by 0.75m wide irrigation channels between the plots. Seedlings were transplanted at a spacing of 60 cm x 60

cm. Salicylic and Benzoic acids were sprayed to the foliage using a portable hand sprayer at vegetative, flowering and fruit setting stages at the rate of 0, 200, 400 and 600 ppm equivalent to 0.2, 0.4 and 0.6 g L^{-1} of water. All plots received full rates of P and K (20 and 37 kg ha^{-1}) in form of ssp (18% P_2O_5) and mop (K_2O) after land preparation. The first rate of N (45 Kg n ha^{-1}), in form of urea was applied one week after transplanting. The remaining balance of 45 Kg n ha^{-1} was applied in form of urea in two split applications at three and six weeks after transplanting (WAT) through banding method of application. Data were collected on plant height, leaf area per plant, per plant, number of branches per plant, number of fruits per plant, average fruit weight and total fruit yield per hectare.

Results and Discussion

Table I shows the results of simple correlation among some growth, yield components and total fruit yield in tomato per plant or hectare. Positive correlation was observed between fruit yield and plant height, leaf area, number of branches $plant^{-1}$, number of fruits $plant^{-1}$ and average fruit weight indicating that these characters are important yield components and critical determinants of fruit yield in tomato. There was a negative correlation between total fruit yield and number of branches $plant^{-1}$. The positive correlation between leaf area and average fruit weight might be attributed to increase in photosynthetic capacity since leaf surface is the medium of photosynthesis therefore, the wider the leaf area, the higher the rate of photosynthesis and more assimilate and its subsequent translocation to the growing organs.

This supported the findings of Ibrahim (2002) who reported a significant positive correlation of leaf number, another measure of photosynthetic capacity of plant with tomato fruit yield. Number of branches was positively correlated with number of fruits $plant^{-1}$ indicating that there was higher number of branches which bore more fruits. However, number of branches was negatively correlated with average fruit weight indicating that the branches could not withstand the weight of the fruits leading to possible dropping of some of the fruits. This result is in conformity with the findings of Younis *et al.* (2000)

The direct and indirect effects of some growth and yield characters on total fruit yield of tomato at BUK in the combined seasons are presented in Table 2. The direct effects of the following characters on total fruit yield of tomato were significant; plant height (21.9818), leaf area (3.5426), number of branches $plant^{-1}$ (21.9036), number of fruits $plant^{-1}$ (31.4438) and average fruit weight (9.6133). The indirect effect of plant height on total fruit yield through leaf area (1.8355), number of branches (7.7238), number of fruits $plant^{-1}$ (0.2117) and average fruit weight (8.5167) was significant. The indirect effect of leaf area on total fruit yield of tomato through number of branches was not significant (-3.7878). However, the indirect effect of leaf area on total fruit yield of tomato through number of fruits $plant^{-1}$ (0.9138) and

through average fruit weight (4.4936) was significant. The indirect effect of number of branches plant^{-1} on total fruit yield of tomato through number of fruits plant^{-1} (13.6853) was significant. The indirect effect of number of branches plant^{-1} on total fruit yield of tomato through average fruit weight (-10.8832) was not significant. The indirect effect of number of fruits plant^{-1} on total fruit yield of tomato through average fruit weight (0.9101) was significant. Out of all these contributions, 12.164% could not be accounted for and were regarded as residuals (Figure 1). At BUK in the combined seasons, the number of fruits plant^{-1} (31.4438) and plant height (21.9818) had the highest direct percent contribution to total fruit yield of tomato than the other measured parameters.

Conclusion

Significant and positive correlations were observed among plant height, leaf area, number of branches plant^{-1}, number of fruits plant^{-1}and average fruit yield of tomato. When the correlation coefficients were partitioned into direct and indirect effects, it was observed that number of fruits plant^{-1} had the highest direct contribution to fruit yield, which was followed by plant height. The highest indirect effect to fruit yield of tomato yield came from leaf area and plant height through fruit weight. The results of this research also indicated that the number of branches plant^{-1} and number of fruits plant^{-1} have contributed both directly and indirectly to fruit yield of tomato. Therefore, it could be suggested that emphasis be given towards increasing the number of branches plant^{-1} and number of fruits plant^{-1} as criteria and basis of selection for higher fruit yield of tomato.

References

Food and Agriculture Organization FAO (2012). Faostat. Retrieved December 29th 2012 from http://faostat.fao.org/site/339/defalt.aspx.

Ibrahim, R. (2002), Correlation studies and percent contributions of different growth and yield characters to total fruit yield of tomato (*Lycopersicon esculatum* Mill) at Samaru, Nigeria: In book of abstracts. *Horticultural Society of Nigeria* Conference held from 14th -17th May, 2002 at National Horticultural Research Institute, Ibadan Nigeria. P.26.

Mahmud, M., Hussaini, M. A., Ibrahim, R. and Emans, E. B. (1997). Correlation and Path-coefficient studies in green gram (*Vigna radiate* (L.) Wilzek) at Samaru, Nigeria. *Proc. 15th Hortson conference,* NIHORT 67 -69

Manga, A.A., Oseni, T.O and Auwalu B.M. (2005). Correlation, Path analysis and Percentage contribution of yield components of grain amaranthus (*Amaranthus cruentus* L.) to seed yield. *Biological and Environmental Science, Journal for the Tropics 2* (1) Pp 86-90.

Periago, M. J., Garcia-Alonso, J., Jacob, K., Olivares, A. B., Bernal, A. J., and Iniesta, M.D.(2009). Bioactive compounds, folates and antioxidant properties of tomatoes *(Lycopersicon esculentum)* during vine ripening. *International Journal of Food Science and Nutrition*, 60 (80): 694-708.

Rakesh, J. and Adarsh, P. V. (2010). Effect of Vermicomposting on Growth, Yield and Quality of Tomato (*Lycopersicon esculentum*L.). *African Journal of Basic and Applied Sciences* 2 (3&4): 117-123.

Sharoni, Y., and Levi, Y. (2006). Cancer prevention by dietary tomato lycopene and its molecular mechanisms. In A. V. Rao (Ed.), Tomatoes, lycopene & human health Barcelona: Caledonian Science Press Ltd pp. 111-125.

Wilcox, J. K., Catignani, G. L., and Lazarus, S. (2003). Tomatoes and cardiovascular health. *Critical Reviews. Food Science and Nutrition*, 43: 1-18.

Younis, M. E., El-Shahaby O.A., Abo-Hamed S.A. and Ibrahim A. H. (2000). Effect of water stress on growth, pigments and C02 assimilation in three sorghum cultivars. Journal of Agronomy Crop Science 185:73-87.

Table I: Simple Correlation Matrix of Growth and Yield Characters of Tomato at Bayero University, Kano 2012 and 2013 Dry Seasons Combined

	1	2	3	4	5	6
TFY	1.00					
PH	0.301**	1.00				
LA	0.342**	0.104	1.00			
NBP	-0.275**	0.176*	-0.021	1.00		
NFP	0.324**	-0.004	0.043	0.259**	1.00	
AFW	0.792**	0.295**	0.385**	-0.375**	0.026	1.00

Note; TFY= Total Fruit Yield, PH=Plant Hight,LA= Leaf Area, NBP=Number of Branches Plant^{-1},NFP= Number of Fruits Plant^{-1},AFW= Average Fruit Weight

Table II. Direct and Combined (%) Contribution of Some Growth and Yield Characters of Tomato and their Residual Effect at BUK in 2012 and 2013 Dry Seasons Combined Seasons.

Characters	% Contribution
Individual/direct contribution	
Plant Height (PH)	21.9818
Leaf Area (LA)	3.5426
Number of Branches Plant^{-1} (BR)	21.9036
Number of Fruits Plant^{-1} (NF)	31.4438
Average Fruit Weight (FW)	9.6133
Indirect/combined contribution	
PH through LA	1.8355
PH through BR	7.7238
PH through NF	0.2117
PH through FW	8.5767
LA through BR	-3.7878
LA through NF	0.9138
LA through FW	4.4936
BR through NF	13.6853
BR through FW	-10.8832
NF through FW	0.9101
Residual	-12.1640
Total	100.0000