Effects of banana peels, poultry and goat manures on soil properties and pepper growth in soils from two parent materials

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ABSTRACT

A pot experiment was conducted at the Greenhouse of Teaching and Research Farm of Akwa Ibom State University, ObioAkpa Campus, to determine the effects of sole and combined applications of banana peels, poultry and goat manures on soil properties and growth of chilli pepper on soils derived from alluvium and coastal plain sand. The pots each containing 5 kg of soil were laid out in a 2 x 6 factorial fitted into a completely randomized design (CRD) with three replications giving a total of 36 experimental units. Pepper seedlings at six weeks were each transplanted from the nursery to the potted soil. Six treatments (banana peels, poultry manure, goat manure, banana peels/poultry manure, banana peels/goat manure and control) were used, each applied at 20 tha^{-1}. Results showed that both pre-experimental soils (Alluvium/Coastal Plain Sand) were loamy sand and sand with strongly acidic pH (5.4/5.2) and low total N (0.52/0.09%), available P (10.84/10.49 $mgkg^{-1}$) and exchangeable K (0.15/0.09 $cmolkg^{-1}$). Treatments applied significantly increased soil pH (5.98/5.78), OM (4.08/3.30%), TN (0.13/0.66%) and available P (31.81/17.77 $mgkg^{-1}$), in both soil relative to control. Growth data of pepper collected at 4, 6, 8 and 10 weeks after transplanting were significant in both soils relative to control. Mean fruit yield/hectare of pepper was significant when all the treatments were applied. The highest fruit yield of 1.41 tha^{-1} was obtained from alluvium soil treated with banana peels plus poultry manure (BPM+PLM). From the results obtained, treatments applied increased soil properties, growth and yield of pepper plants.

Keywords: Banana peels; poultry manure; goat manure; soil properties; parent materials.

INTRODUCTION

Poor soil fertility is one of the greatest constraints to increasing agricultural productivity that is currently threatening food security in Nigeria (Mugwe *et al*., 2009). One of the major causes of decline in crop yield and per-capita food production is depletion in soil nutrient (Udom *et al*., 2019). The use of organic manure has been identified as a sustainable soil conservation technique in improving crop production in the tropics (Westerman and Bicudo, 2003). Poor cultivation practices such as continuous cropping could result in low soil fertility through a reduction in soil organic matter (SOM), and an increase in soil acidity (Aihou *et al*., 2008).

The use of inorganic fertilizers alone may cause problems to plants and despite the effectiveness of these fertilizers, their

adoption and uses have been associated with several problems such as inadequate supply or even unavailability at the time of need and high cost. Continuous cropping may lead to a decline in soil organic matter content, soil acidification and soil physical degradation, leading to increase in soil erosion (Ojeniyi, 2000).

In view of these problems, attention has moved from inorganic fertilizers to organic manure as a superior option to improve crop yield. Manure is the decomposed form of dead plants and animals, which is applied to the soil to increase its fertility and productivity. According to Umoh*et al.* (2022), the use of animal manures from Goat, Poultry and Pig production systems increases organic carbon content and the population of soil microorganisms, improves soil structure and enhances crop yield. It has been reported by Ekwere *et al*., 2023; Iren *et al*., 2016; Umoh *et al*., 2023 that Rabbit, Pig, Goat and Poultry manures are efficient organic manures which contain high levels of N,P,K, Ca and Mg, that makes a great improvement to soil properties and crop yield.

Chilli pepper (*Capsicum sp.*) which is one of the most known species in the world, is one of the important vegetables grown in Nigeria and other parts of the humid and semi- arid tropics (Aliyu, 2000). Pepper belongs to the family Solanaceae. Chilli pepper production in Nigeria is constrained by low soil fertility. In order to obtain high yield of pepper, there is need to improve the nutrient status of the soil through application of manures to meet crops' needs. Based on the fact that inorganic fertilizers are expensive and environmentally unfriendly, this study was aimed at evaluating the effects of sole and combined applications of banana peels, poultry and goat manures on selected soil properties, growth and yield of chilli pepper (*Csapsicum Spp.)* grown on soils of two parent materials.

MATERIALS AND METHODS

The Study Area

The research was carried out in 2024 at the Green House of Teaching and Research Farm of Akwa Ibom State University, Obio Akpa Campus in Oruk Anam Local Government Area. The area lies between Latitudes 4^0 30N and 5^0 30N and Longitudes $7^0$30E and $8^0$00E (SLUK- AK, 1989). The area has a humid tropical climate with an annual rainfall ranging from 2500 to 3000mm and annual mean temperature of about 27^0C. Relative humidity ranges from 75 to 79 %.

Collection and Preparation of Research Materials

Potting bags and Pepper seeds were purchased from Next Crown Agro Ltd, Aka Itiam, Uyo. Animal manures (poultry and goat) were collected from Arize Farms and Enterprise. While Banana peels source of treatment were produced by the researcher. Banana peels were oven dried for 30minutes at a temperature of 71.11 degrees Celsius. The banana peels were successfully oven dried, blended with a 750W GSR Power blender into a finer powder, stored in a polytene bag and kept for use. Poultry and goat manures were air dried at the laboratory, crushed and sub sample taken for analysis. Composite soil samples were randomly collected at 0-15cm depths from two different locations namely, Utaewa in Ikot Abasi and Ikot Ambon in Ibesikpo Asutan using soil auger. The soil samples used for the

experiment were air dried and passed through a 4mm size sieve to remove debris and large stones. Sub samples of the soil were taken and passed through 2mm sieve for routine laboratory analysis to determine the nutrient status of the soil used for the experiment.

A nursery bed measuring 2m × 1m was raised under a partial shade made from palm leaves. Organic manure, 4 kg (equivalent to 20t/ha) were broadcasted on the nursery bed and allowed for one week (Iren *et al*., 2011). After one week, pepper seeds were broadcasted on the nursery bed, watered regularly to ensure good germination. At 6weeks after planting, the seedlings were matured for transplanting. Each potting bag was filled with 5 kg of the 4 mm sieved soil, watered to field capacity and allowed to stand for a day before planting pepper seedlings.

Experimental Design, Treatments and Treatment Allocation

A pot experiment was laid out in a 2 x 6 factorial fitted into Completely Randomized Design (CRD) with three (3) replications giving a total of 36 experimental units. Factor A represent the soils from 2 parent materials (alluvium soil and coastal plain sand), while Factor B represent the six (6) manure combinations (banana peels manure, poultry manure, goat manure, banana peels + poultry manure, banana peels + goat manure) each applied at 20 t/ha and a control (no amendment).

Planting and Maintenance of the Experimental Units

The pepper seedlings were removed singly using a hand trowel with a ball of the earth and transplanted at 4 inches depth into the potting bags at one seedling per bag under cool weather in the evening. At two weeks after transplanting (2WAT), 50g (equivalent to 20 t/ha) of each of the manures were added to specified pots. Watering was done at regular interval while weeding was done manually by hand picking when necessary.

Growth Data and Soil Sample Collection

The following growth parameters were collected from 4 weeks after transplanting and subsequently at 2 weeks interval. Plant height was measured with a meter rule as the height from the ground level to the tip of the plant. Number of branches and number of leaves per plant was counted. Stem girth was measured at a point that is about 5cm from the ground by tying a string around the plant stem and length of the string read off from a meter and the value in cm multiplied by a pie,

Number of fruits per pot was recorded for each harvest and the total collected were calculated as number of fruits per plant. Fruit length (cm) and fruit diameter (cm) were measured with a measuring tape and recorded at each harvest. Fresh weight of fruit was determined by weighing the total fruit harvested per pot. The yield obtained was extrapolated in tons per hectare. At the end of the experiment, soil samples were collected from each pot using a hand trowel, air dried at the laboratory, crushed with mortar and pestle and passed through a 2 mm sieve and stored in labelled polythene bags. The soil samples collected were taken to the laboratory for analysis.

Laboratory Studies

The following analyses were carried out on the samples using standard procedures as described by Udo *et al*. (2009): Particle size distribution was determined by the Bouyoucous hydrometer method. Soil pH was determined using a ratio of 1:2 in soil-water medium and read with a digital pH meter. Organic carbon content was determined by Walkley-Black dichromate oxidation method. Organic matter was obtained by multiplying total carbon by a factor of 1.724.Total nitrogen (N) was determined by micro-kjedahl method. Available phosphorus (P)was extracted by the Bray 1 extraction method, and the content P was determined calorimetrically using a Technico AAII auto analyser (Technico, Oakland, Calif).Determination of exchangeable bases was by neutral ammonium acetate extraction. Calcium (Ca) and magnesium (Mg) were read with an atomic absorption spectrometer (AAS), while sodium (Na) and potassium (K) were read with flame photometer. Exchangeable acidity was determined by the 1 N potassium chloride (KCI) extraction method and titrated with 1 M sodium hydroxide (NAOH) using phenolphthalein as an indicator. The effective cation exchange capacity (ECEC) was computed by summation of total exchangeable bases and exchangeable acidity. Base saturation (BS) was obtained by calculation using the formula: BS = Sum of Exchangeable bases x 100 divided by the effective cation exchange capacity (ECEC). Samples of the manures were also subjected to chemical analysis using standard procedures as described by Udo *et al*. (2009). Data collected were subjected to analysis of variance (ANOVA) and means compared using Fisher's Least Significant Difference (FLSD) at 5% probability level.

RESULTS AND DISCUSSION

Properties of the Soils and Manures Used for the Study

The texture of the soils varied from sand (coastal plain sand) to loamy sand (alluvium soil). The difference in percentage sand, silt and clay content of the experimental soils shows the variation in the parent materials (Table 1). The reaction of the soils was slightly acidic, based on the rating of Aduayi *et al.* (2002). Values ranged from 5.2 (coastal plain) to 5.4 (alluvium). The result from this study confirms the findings of Okon *et al.* (2016)who reported that addition of farm yard manure resulted in a significant ($P \leq 0.05$) increase in soil pH. The soils were non-saline with low electrical conductivity, indicating that the soils were salt free. This result agrees with the reports of Ekong and Uduak (2014); and Uduak *et al,* (2020).The organic matter contents of the soils were above the critical level of $2gkg^{-1}$ proposed by Aduayi *et al*. (2002). Total nitrogen (0.10/0.09 %) and available phosphorous ($10.84/10.49mgkg^{-1}$) were below the critical level of $2gkg^{-1}$and 12 $mgkg^{-1}$in alluvium/coastal plain soil respectively. Exchangeable K contents were low in both soils. This agrees with the work of Ijah *et al*. (2024). The chemical compositions of the animal manures used for the study are presented in Table 2. The pH values of all the animal manures under consideration indicated that they were alkaline in reaction.

Effects of treatments on the soil properties of two parent materials

Table 3 shows the effects of treatments on soil properties of two parent materials. There was no significant effect of treatments on the particle size distribution of the soils, though there were slight changes in the sand, silt and clay content. This was as expected since particle size distribution is an inherent property of the soil. Soil pH was significantly (P≤0.05) affected by the treatments in both soils, but the effects were more in alluvium soil than in coastal plain sand. The highest pH value of 6.20 was obtained from banana peels treated soil, followed by poultry manure (5.96) while the least value of 5.50was obtained from the control. The high pH values obtained in the amended soil compared with control in both soils could be attributed to the release of bases (Ca, Mg, K, Na) from the manures (Akanni *et al*., 2008). This is in agreement with the findings of Iren *et al.* (2015), who observed that animal manures increased the pH of soils in southern Nigeria. The electrical conductivity (EC) of the treated soils was not significantly affected by the treatments. The low EC of the soil is an indication of the fact that the treatments applied were non-saline and therefore did not contribute to soil salinity. Soil organic matter increased significantly in all the treated soils when compared with the control soils. Total N increased significantly in the treated plot when compared with the control but no significant difference was observed among the treatments.

Effects of treatments on the growth parameters of pepper grown on two parent materials

Results presented in Table 4 shows the effects of treatments on the plant height of pepper at 4, 6, 8 and 10 weeks after transplanting (WAT). The application of different manure sources significantly (P≤0.05) increased the plant height of chilli pepper relative to control. At 10 WAT, the tallest plant was obtained from coastal plain soil when banana peels manure (BPM) was applied. A similar result was observed by Ijah *et al.*(2019) where organic manure increased plant height, number of leaves, stem girth and fruit weight of pepper on coastal plain sand of Obio Akpa.

The effects of treatments on number of leaves of chilli pepper at 4, 6, 8 and 10 WAT are presented in Table 5. From the results obtained, treatments applied significantly (P≤0.05) increased number of leaves of chilli pepper. The highest number of leaves of pepper at 10 WAT was produced by BPM+PLM treated soil while the lowest leave number was produced from control soils. This result is in line with that of Ewulo *et al.*(2007) who reported that organic manure (cow dung) treatment at 2.5t/ha^{-1} increased growth and fruit yield parameters of pepper at Ondo, Southwest Nigeria.

Table 6 shows the effect of treatments on the stem girth of pepper at 4, 6, 8 and 10 WAT on two parent materials. Stem girth of pepper was significantly (P≤0.05) affected by all the treatments. The highest stem girth of 2.517 cm was obtained from coastal plain sand. A similar result was observed by Ijah *et al*. (2019) at the Teaching and Research Farm of Akwa

Ibom State University, where application of organic manure at the rate of 6 t/ha increased plant height, number of leaves, stem girth and fruit weight of pepper.

Effects of treatments on the mean yield components of chili pepper

Mean yield of pepper as affected by banana peels manure (BPM), poultry manure (PLM), goat manure (GOM), BPM+PLM, BPM+GOM and control is shown in Table 7. From the results obtained, banana peels, poultry manure, goat manure, banana peels/poultry manure and banana peels/goat manure treatments significantly ($P \leq 0.05$) increased the mean number of pepper in soils of both parent materials. The values obtained from alluvium soil treated with BPM, PLM GOM, BPM+PLM, BPM+GOM and control had mean number of fruits per plant of 11.67, 10.67, 12.33, 6.33 and 2.67, respectively. Coastal plain sand had mean fruit number of 9.30, 7.33, 8.88, 8.1 and 2.67 from BPM, PLM GOM, BPM+PLM, BPM+GOM and control, respectively. The result agrees with Ijah *et al.* (2018) who reported that application of organo-minerial fertilizer at 5 t/ha^{-1} significantly ($P \leq 0.05$) increased number of fruit, fruit weight and fruit yield of chilli pepper. Mean fruit weight per plant was also significantly ($P \leq 0.05$) affected by the treatments. The highest mean fruit weight of 48.19 g was obtained by plants treated with BPM+PLM on alluvium soil, though not different from other treatments, but was significantly higher when compared with the control (9.65 g). This study agrees with Bakry*et al*. (2016) who reported that banana peels provide nutrient to plants when used in gardens.

Fruit yield per hectare was also significantly affected by all the treatments. The highest mean fruit yield (1.41 tha^{-1}) was obtained from alluvium soil when BPM+PLM was applied while the least (0.57 tha^{-1}) was obtained from the soil treated with GOM but was significantly higher relative to control (0.28 tha^{-1}).

The results from this study also showed that application of BPM, PLM, GOM, BPM+PLM and BPM+GOM in both soils significantly increased the growth and yield performances of pepper relative to control. As the stage of development progressed, alluvium soil appears to support greater yield of pepper plant more than coastal plain soil. Fresh fruit yield per hectare of chilli pepper was higher in alluvium soil than in coastal plain soil. The higher fresh fruit yield in alluvium soil could be due to high amount of organic matter content in the soil. Boettinger (2005) reported that alluvial soils are some of the world's most useful and productive soil resources.

Correlation matrix between growth and yield of chilli pepper on two parent materials

Table 8 shows a significant positive relationship between growth and yield of chilli pepper in alluvium soil. Fruit weight had a strong significant relationship with fruit length (r = 0.814*), fruit diameter (r = 0.890*), number of fruit (r = 0.854*), plant height (r = 0.929*), number of leaves (r = 0.890*) and number of branches (r = 0.953**).

As shown in Table 9, there was a strong significant positive relationship between growth and yield of chilli pepper in coastal plain soil; Fruit weight, fruit length (r = 0. 941**), fruit diameter (r = 0.903*), number of fruit (r = 0.892*), plant height (r = 0.869*), number of leaves (r = 0.821*) number of branches (r = 0.853**) and stem girth (r = 0. 930**).

Conclusion and Recommendation

Banana peels, poultry and goat manures are good in enhancing soil fertility, crop growth and yield, but the combined application of banana peels manure/poultry manure (BPM+PLM) on alluvium soil gave the highest yield and is therefore recommended for optimal nutrient supply for chilli pepper in the study area.

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Table 1: Physicochemical Properties of the soil used for the experiment

Properties	Values	
	Alluvium	Coastal Plain
Sand (%)	84.60	89.32
Silt (%)	6.09	2.58
Clay (%)	9.31	8.10
Textural class	Loamy Sand	Sand
Soil pH (H_2O)	5.4	5.2
EC (dsm^{-1})	0.22	0.14
Total nitrogen (%)	0.52	0.09
Organic matter (%)	3.7	3.2
Available P ($mgkg^{-1}$)	10.84	10.49
Exch. Ca ($cmolkg^{-1}$)	4.19	3.41
Exch. Mg ($cmolkg^{-1}$)	1.60	1.10
Exch. K ($cmolkg^{-1}$)	0.15	0.09
Exch. Na ($cmolkg^{-1}$)	0.07	0.05
EA ($cmolkg^{-1}$)	1.58	1.97
TEB ($cmolkg^{-1}$)	6.01	4.65
ECEC ($cmolkg^{-1}$)	7.59	6.62
Base Saturation (%)	79.18	70.24

Table 2: Chemical composition of manures used for the experiment

Parameter	PLM	GOM	BPM

pH (H_2O)	8.65	8.41	8.98
EC (dsm^{-1})	1.93	1.81	1.72
Total N (%)	4.31	2.39	3.59
Total P (%)	15.11	0.76	12.89
Org. C (%)	58.20	45.40	51.39
Ca (%)	4.52	3.92	5.41
Mg (%)	1.35	0.41	0.92
K (%)	0.76	0.32	0.81
Na (%)	0.24	0.10	0.11

EC = electrical conductivity, PLM= poultry manure, GOM= goat manure, BPM= banana peels manure.

Table 3: Effects of Treatments on the Physicochemical properties of the soil after the experiment

Manures	Particle size (%)			pH	EC	OM	TN	Av.P	Exch. Bases ($cmolkg^{-1}$)				EA	ECEC	BS
	Sand	Silt	Clay	H_2O	dsm^{-1}	%	%	$Mgkg^{-1}$	C a	Mg	Na	K	$Cmolkg^{-1}$	$Cmolkg^{-1}$	%
Control	87.04	4.395	8.565	5.50	0.135	2.780	0.210	13.46	3.275	1.620	0.065	0.080	1.357	6.397	78.79
BPM	85.67	5.370	8.960	6.20	0.112	3.885	0.425	28.09	5.220	3.150	0.070	0.155	1.225	9.820	87.53
PLM	85.70	5.271	9.029	5.96	0.125	4.110	0.495	27.95	5.245	2.690	0.060	0.175	1.150	9.320	87.66
GOM	86.74	4.520	8.740	5.69	0.128	3.585	0.325	22.42	4.160	2.455	0.070	0.155	1.250	8.090	84.55
BPM+PLM	86.06	4.725	9.215	5.93	0.121	4.010	0.526	29.18	4.930	2.943	0.060	0.130	1.155	9.218	87.47
BPM+GOM	86.48	4.920	8.600	5.83	0.095	3.745	0.420	27.66	4.535	2.300	0.065	0.155	1.225	8.280	85.31
LSD ($p<0.05$)	0.823	0.095	0.036	0.040	NS	0.036	0.048	0.197	0.040	0.609	0.017	0.011	0.039	0.466	0.021
PARENT MATERIALS															
ALV	83.89	6.400	9.710	5.93	0.125	4.081	0.138	31.81	3.380	2.548	0.066	0.110	0.653	6.757	90.35
CPS	88.79	3.236	7.974	5.78	0.125	3.290	0.661	17.77	5.741	2.504	0.063	0.173	1.800	10.281	82.49
LSD ($p<0.05$)	0.475	0.054	0.020	0.023	0.016	0.021	0.013	0.113	0.023	0.352	0.010	0.020	0.022	0.269	0.012

Key: BPM = Banana peels manure, PLM = poultry manure, GOM= goat manure, ALV = alluvium soil, CPS= coastalplain

Table 4: Effects of banana peels, poultry and goat manure on plant height of pepper

Treatments	Plant height (cm) (Weeks after transplanting)			
	4	**6**	**8**	**10**
Control	10.02	16.38	18.88	22.85
BPM	18.15	29.32	33.47	46.60
PLM	18.08	30.70	34.58	47.50
GOM	14.87	24.17	26.85	36.43
BPM+PLM	17.77	27.22	34.73	50.77
BPM+GOM	16.10	25.63	29.78	44.02
LSD ($p<0.05$)	0.841	0.891	2.206	2.938
PARENT MATERIAL				
Alluvium	13.30	21.53	25.18	35.73
Coastal Plain	18.36	29.61	34.25	46.99
LSD ($p<0.05$)	0.486	0.514	1.274	1.696

Table 5: Effects of treatments on the mean number of leaves of chilli pepper

Treatment	Number of Leaves (Weeks after transplanting)			
	4	**6**	**8**	**10**
Control	7.00	8.67	10.17	10.17
BPM	12.33	16.83	22.33	22.23
PLM	12.50	15.83	23.50	23.50
GOM	10.33	13.83	18.50	18.50
BPM+PLM	12.33	17.50	24.83	24.83
BPM+GOM	11.33	14.50	20.33	20.33
LSD ($p<0.05$)	1.091	1.627	2.036	2.036
PARENT MATERIAL				
Alluvium	9.72	12.00	16.38	16.83
Coastal plain	12.22	17.06	23.06	23.06
LSD ($p<0.05$)	0.630	0.939	1.175	1.175

Key: BPM = Banana peels manure, PLM = poultry manure, GOM= goat manure.

Table 6: Effects of banana peels, poultry and goat manure on the stem girth (cm) of Pepper

Treatment	Stem girth (Weeks after transplanting)			
	4	**6**	**8**	**10**
Control	0.700	1.017	1.133	1.167
BPM	1.200	1.867	2.033	2.333
PLM	1.150	2.083	2.233	2.517
GOM	1.100	1.433	1.583	1.800
BPM+PLM	1.283	1.667	1.750	2.167
BPM+GOM	1.067	1.417	1.600	1.833
LSD (p<0.05)	0.096	0.178	0.158	0.126
PARENT MATERIAL				
Alluvium	1.011	1.144	1.289	1.556
Coastal plain	1.156	2.017	2.156	2.383
LSD (p<0.05)	0.056	0.103	0.091	0.073

Key: BPM = Banana peels manure, PLM = poultry manure, GOM= goat manure,

Table 7: Effects of banana peels, poultry and goat manure on mean yield of chilli pepper (cm)

Treatment	No of Fruit/ Plant	Fruit Weight (g)	Fruit Length (cm)	Fruit width (cm)	Fruit Yield (t/ha)
Control	2.667	9.65	3.573	4.035	0.28
BPM	10.231	33.33	6.372	7.358	1.30
PLM	10.167	48.19	6.403	7.320	1.27
GOM	7.167	20.49	5.322	6.093	0.57
BPM+PLM	10.333	44.21	6.887	7.440	1.41
BPM+GOM	8.000	29.60	5.868	6.642	0.61
LSD (p<0.05)	2.884	4.10	0.427	0.644	0.40
	PARENT MATERIAL				
Alluvium	8.72	33.80	5.41	5.80	0. 73
Coastal plain	7.50	28.00	6.07	7.17	0.63
LSD (p<0.05)	1.665	2.37	0.247	0.372	0.37

Key: BPM = Banana peels manure, PLM = poultry manure, GOM= goat manure,
BPM+PLM= banana peels + poultry manure, BPM+GOM = banana peels + goat manure.

Table 8: Correlation matrix between growth and yield of pepper on Alluvium Soil

Treatment	FW	FL	FD	NF	PHT	NLS	NBS	SG
FW	1							
FL	0.814*	1						
FD	0.890*	0.797	1					
NF	0.854*	0.826*	0.801	1				
PHT	0.929*	0.959**	0.916*	0.867*	1			
NLS	0.890*	0.925**	0.899*	0.925*	0.948**	1		
NBS	0.953**	0.872*	0.888*	0.941**	0.935**	0.977**	1	
SG	0.785	0.980**	0.762	0.891*	0.932**	0.922**	0.972*	1

Table 9: Correlation matrix between growth and yield of pepper on Coastal Plain Soil

	FW	FL	FD	NF	PHT	NLS	NBS	SG
FW	1							
FL	0.941**	1						
FD	0.903*	0.977**	1					
NF	0.892*	0.960**	0.988**	1				
PHT	0.869*	0.961**	0.911*	0.922**	1			
NLS	0.821*	0.901*	0.809	0.824*	0.977**	1		
NBS	0.853*	0.904*	0.815*	0.807	0.965**	0.977**	1	
SG	0.930**	0.960**	0.950**	0.906*	0.852*	0.773	0.781	1

** Correlation is significant at 0.01 level (2-tailed)

* Correlation is significant at 0.05 level (2-tailed)

Key: FW= Fruit weight, FL= Fruit length, FD =Fruit diameter, NF = Number of fruit,PHT=Plant height, NLS = Number of leaves, NBS = Number of branches, SG = Stem girth