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Productivity Of *Citrullus Lanatus* As Affected By Cowdung-Poultry Droppings (COPODS), Spacing And Variety In Gashua, Nigeria

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Abstract:
This research aimed to examine the influence of varying levels of cow dung-poultry droppings (COPODs) and plant spacing on the growth and yield of different watermelon varieties. Four COPOD levels ([without COPODs], [4t + 1t COPODs], [8t + 2t COPODs], and [12t + 3t COPODs]), four plant spacing options (25, 50, 75, and 100 cm), and four watermelon varieties (Sugar baby, Koalack, Royal sweet, and Paradise) were combined in a factorial experiment to assess their effects on key growth metrics, including vine length, leaf production, fruit weight, and yield. The study found that increasing levels of COPODs and wider plant spacing significantly promoted vine length, leaf production, fruit weight, and overall yield. Among the varieties tested, Koalack demonstrated the most vigorous growth, although differences between varieties were not always statistically significant. While interactions between COPODs, spacing, and variety generally did not produce significantly different outcomes, there were notable interactions between COPODs and spacing, as well as between spacing and variety. These results highlight the importance of organic fertilization and appropriate plant spacing in enhancing the growth and yield of watermelon varieties. The findings suggest that adopting a combination of wider planting distances and adequate applications of COPODs can be a valuable strategy for maximizing watermelon production.

Keywords: *Productivity, Citrullus lanatus variety, COPODs fertilization, watermelon, Gashua*

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I. Introduction

Watermelon is one of the most widely cultivated vegetable fruits globally, with consumption surpassing that of other crops in the *Cucurbitaceae family* (Gichimu *et al.,* 2008). As global demand increases, over 6 billion people may rely on specific countries for their watermelon supply. Countries in tropical regions hold a significant advantage in meeting this demand, as their favorable climatic and soil conditions allow for year-round production. Watermelon is grown both for its large fruits, which can weigh up to 18 kg depending on the variety (Ban *et al.,* 2006), and for its highly nutritious vegetative parts (Schippers, 2000).

The watermelon production increases under intensive cropping systems (Clough, 1992; Robinson and Decker-Walters, 1997; Hochmuth *et al.,* 2001; Bolin and Brandenberger, 2001). These systems involve various agronomic practices, including irrigation, cultivation techniques, plant spacing, variety selection, and the management of weeds, pests, and diseases, all of which influence crop yield (Taylor *et al.,* 2003). According to Lu *et al.* (2003), these combined practices significantly enhance watermelon production, leading to a 100% increase in the weight and number of marketable fruits. Additionally, increasing plant density has been shown to boost yield per plot (NeSmith, 1993). However, watermelon yields are highly variable and depend on different cropping conditions (Korkmaz and Dufault, 2001; Snyder *et al.,* 1991; Fernandez-Bayon *et al.,* 1993; Scott *et al.,* 1993; Gimeno *et al.,* 1999; Fumagalli *et al.,* 2001; Watanabe *et al.,* 2001; Lu *et al.,* 2003). Although many studies have assessed production management, most focus on one or two specific cultural practices (Ban *et al.,* 2006; Dantata, 2014). There is a lack of research, particularly in the study area, on watermelon productivity that incorporates multiple cultural practices, such as the use of fortified cow dung-poultry droppings (COPODs), varying plant spacing, and different crop varieties. Therefore, this study aims to evaluate the impact of these factors on watermelon productivity in Gashua, a Sahelian region of Nigeria.

II. Materials And Methods

Field experiment was conducted at a community based-demonstration farm in Gashua, Yobe State, Nigeria during the 2016/2017 dry season. The site is situated in the sahel region - Sudan Savannah ecological zone of Nigeria, approximately latitude 12^0 51'31''N, longitude 11^0 2'51''E and altitude of 353.8m. The rainfall of the area is erratic and poorly distributed occurring between July to September with an annual mean range between 350-680mm (Kowal and Knabe, 1972). Soil of the experimental site and cow-poultry droppings (COPODs) applied were clay loam and appreciably rich in mineral nutrients (Dantata, 2008).

Treatments consisted of 4 rates of cow-poultry droppings (COPODs) ([without COPODs], [4t + 1t COPODs], [8t + 2t COPODs] and [12t + 3t COPODs]), 4 varieties of watermelon (Sugar baby, Koalack, Royal sweet and Paradise) and 4 planting distances (25, 50, 75 and 100 cm) laid in a randomized complete block design (RCBD) with 4 replications. The land was ploughed, harrowed and made to a fine tilt. Sunken beds of 4m x 4m were raised. The plots were spaced 1m x 0.5m between and within replications. Hybrid seeds of the specified watermelon varieties were sown directly into the plots on 10th October, 2016 according to the planting distance- treatments. Four seeds of each watermelon variety were sown and later thinned to one per stand at 3 weeks after sowing (WAS). Eight plants from the net plot (12.3m^2) were randomly selected and tagged from which growth and yield data, including vine length, leaf count, fruit weight, and yield, were collected weekly for 11 weeks after sowing. Statistical analysis was performed to assess the significance of treatment effects and interactions using standard procedures (Steel and Torrie, 1980; Dantata, 2008; Dantata and Oseni, 2009; Dantata, 2014) and, differences between means determined by Duncan's multiple range test [DMRT] (Duncan, 1955) in the General Linear Model (GLM) of SPSS (1996).

III. Results And Discussion

Table 1 examines how different levels of cow dung and poultry droppings (COPODs), plant spacing, and watermelon varieties impact vine length at various stages of growth (5-11 weeks after sowing). At 0 t/ha COPODs, vine length increases from 26.547 cm at 5 weeks to 81.219 cm at 11 weeks. This growth pattern, while consistent, is slower compared to treatments with higher COPODs. At 4CO+1PODS level, vine length improves from 29.266 cm at 5 weeks to 88.375 cm at 11 weeks. This indicates that even a moderate amount of COPODs has a beneficial effect on vine elongation. Treatment, 8CO+2PODS, shows a similar trend with increased vine length, starting at 29.672 cm at 5 weeks and reaching 93.672 cm at 11 weeks. The increase in vine length with this treatment is substantial compared to lower COPOD levels. The highest COPOD treatment, 12CO+3PODS, results in the greatest vine length, starting at 31.047 cm at 5 weeks and growing to 95.531 cm at 11 weeks. This suggests that the highest level of organic input provides the most significant growth advantage. Spacing from 25- 100cm results in the shortest vine lengths, starting at 24.266 cm at 5 weeks and reaching 80.516 cm at 11 weeks (with 25cm). Vine length increases to 29.437 cm at 5 weeks and 90.859 cm at 11 weeks (with 50cm), similar trend was observed with 75cm spacing. Greatest vine length, starting at 32.781 cm at 5 weeks and growing to 95.484 cm at 11 weeks was also observed with 100 cm spacing. Koalack crop variety shows consistent vine length across the growing period, with a final length of 93.547 cm at 11 weeks. Sugar baby is slightly lower than 'Koalack', reaching 89.297 cm at 11 weeks 'Koalack' appears to have a robust growth pattern, supporting its reputation for strong vine development. Royal sweet shows similar growth to 'Sugar baby', with a final vine length of 88.922 cm at 11 weeks. Paradise variety has the lowest vine length, reaching 87.031 cm at 11 weeks. Treatments interactions were not significant except, COPODs and spacing (Table 2) with spacing and variety (Table 3) interactions. COPODs and spacing interaction shows that while both factors independently influence vine length, their combined effect is not always significant. For instance, although higher COPOD levels and wider spacing both promote vine elongation, the interaction between them does not always lead to significantly different outcomes across all spacings. The interaction between spacing and variety shows that wider spacing generally benefits all varieties, but the degree of benefit varies. For instance, Koalack and Sugar baby exhibit greater improvements in vine length with increased spacing compared to Royal sweet and Paradise.

The trend observed in Table 1 aligns with findings from Dantata (2008) who reported that increased organic fertilization promotes vigorous plant growth, including vine length, by improving nutrient availability and soil structure. These results are consistent with Dantata and Babatunde (2013), who found that wider spacing enhances plant growth, including vine length, by minimizing competition and allowing better resource utilization. The observations about variety-specific growth are supported by Hernandez *et al.* (2010), who found that different watermelon varieties exhibit distinct growth patterns and vine lengths, influenced by their genetic traits. The interactions observed are consistent with findings from Dantata *et al.* (2010), who noted that while individual factors like spacing and fertilization have significant effects on plant growth, their interactions may not always produce significantly different outcomes depending on the specific growth stage or variety.

Effect of COPODs, spacing, and variety on number of leaves of watermelon at 5-11 weeks after sowing (Table 4) presents the impact of different levels of cow dung and poultry droppings (COPODs), plant spacing, and watermelon varieties on the number of leaves at 5, 6, 7, 8, 9, 10, and 11 weeks after sowing. Trends over periods shows that number of leaves starts at 18.812 at 5 weeks and increases to 76.172 at 11 weeks with 0 t/ha COPODs. At 4CO+1PODs, leaves production starts at 20.953 at 5 weeks and increases to 86.937 leaves at 11 weeks. Application of 8CO+2PODS, begins with 22.453 leaves at 5 weeks and grows to 92.875 leaves at 11 weeks. While, 12CO+3PODS: Starts at 22.938 leaves at 5 weeks and ends with 94.422 leaves at 11 weeks. This treatment shows the highest number of leaves throughout the growing period, suggesting that the highest level of COPODs is most beneficial for leaf development. This indicates improved growth compared to lower levels of COPODs, especially as the season progresses. These findings are consistent with Dantata (2008), which reported that increased organic fertilization generally improves leaf production by enhancing nutrient availability and supporting better plant growth. Effect of spacing on number of leaves revealed that 25 cm spacing begins at 18.906 leaves and increases to 82.438 leaves by 11 weeks. This spacing shows relatively lower leaf counts compared to wider spacings, likely due to increased competition among plants.

Spacing at 50 cm starts at 20.516 leaves and increases to 83.406 leaves. This spacing provides a moderate improvement in leaf number over 25 cm spacing, but not as much as wider spacings. At 75 cm spacing, number of leaves rose to 22.641 and grows to 91.109 leaves. This spacing shows better leaf development compared to narrower spacings, indicating that less plant competition supports better growth. Spacing at 100 cm starts at 23.094 leaves and reaches 93.453 leaves. This is the most favorable spacing for leaf development, as it allows plants the most room to grow with minimal competition. The results align with Dantata (2008), which observed that wider plant spacing enhances leaf production by reducing competition and allowing better access to resources.

Koalack variety shows a consistent number of leaves from 22.547 at 5 weeks to 90.906 at 11 weeks. This variety generally has higher leaf counts compared to others, indicating better growth. Sugar baby starts at 21.578 leaves and reaches 87.250 leaves by 11 weeks. This variety shows slightly lower leaf production compared to 'Koalack' but still performs well. Royal sweet begins with 20.781 leaves and grows to 86.328 leaves. The growth pattern is similar to Sugar baby, with a slightly lower leaf count. Paradise starts at 20.250 leaves and increases to 85.922 leaves. This variety shows the lowest leaf count among the varieties, although it still improves over time. The findings are in line with Gichimu *et al.* (2008), which reported that different watermelon varieties exhibit varied growth patterns and leaf numbers due to inherent genetic differences. All treatments interactions were not significant, except spacing and variety at weeks 8, 9, 10 and 11 (Table 5). Different varieties respond differently to changes in spacing, with wider spacings generally benefiting all varieties. The interaction findings are supported by Dantata *et al.* (2010), who noted that while individual factors like spacing and fertilization have significant effects on plant growth, their interactions can vary depending on the growth stage and specific plant variety.

Results on effects of compost organic (COPODs), plant spacing, and watermelon variety on fruit weight (kg) and fruit yield (t/ha) (Table 6) revealed that zero application (0 t/ha) of compost gave average fruit weight of 19.039 kg. The fruit weight increased with the application of compost, reaching 21.720 kg at 4CO+1PODS and 24.869 kg at the highest compost level (12CO+3PODS). Fruit yield followed a similar trend, at 0 t/ha, the yield was 26.650 t/ha. The yield increased progressively with higher compost levels, peaking at 36.437 t/ha with 12CO+3PODS. Both fruit weight and fruit yield showed significant differences, meaning that compost levels had a statistically significant effect on these parameters. Higher compost levels resulted in heavier fruits and higher yields, indicating that increased nutrient availability through compost enhanced fruit development and productivity. Fruit weight and yield with spacing, shows that narrow spacing (25 cm) resulted in smaller fruit weight, with an average of 18.589 kg. As the spacing increased, the fruit weight also increased, with the widest spacing (100 cm) producing the heaviest fruits (25.509 kg). Similar to fruit weight, fruit yield was lower at narrow spacing (28.091 t/ha at 25 cm). As spacing widened, yields increased, reaching 37.194 t/ha at 100 cm spacing. Both fruit weight and yield were significantly affected by plant spacing. Wider spacing (75 cm and 100 cm) produced significantly heavier fruits and higher yields compared to narrower spacings (25 cm and 50 cm). This suggests that wider spacing reduced competition for resources (light, water, nutrients), allowing better fruit development. The fruit weights across varieties were fairly similar, with Koalack producing the heaviest fruits (22.856 kg), followed by Sugar baby (22.184 kg) and Royal sweet (22.019 kg). Paradise produced slightly lighter fruits (21.527 kg). In terms of fruit yield, Koalack also had the highest yield (32.838 t/ha), followed by Sugar baby (32.663 t/ha), Royal sweet (32.394 t/ha), and Paradise (31.400 t/ha). Despite small differences in fruit weight and yield among the varieties, these differences were not statistically significant. This suggests that the variety of watermelon used did not have a major impact on fruit weight or yield under the given conditions.

Treatments interactions were not significant, except, COPODS and spacing (Table 7) as well as variety and spacing (Table 8). The lowest fruit weight (19.039 kg) was observed in watermelons grown without any compost (0 t/ha). As compost levels increased, fruit weight also increased, with the highest weight (24.869 kg) achieved with 12CO+3PODS. Similarly, the lowest fruit yield (26.650 t/ha) was recorded in the 0 t/ha treatment. Yield increased significantly with compost levels, peaking at 36.437 t/ha in the 12CO+3PODS treatment. Interaction between COPODS and spacing for both fruit weight and yield indicated lowest fruit weight (19.039 kg) observed in watermelons grown without any compost (0 t/ha). As compost levels increased, fruit weight also increased, with the highest weight (24.869 kg) achieved with 12CO+3PODS.Likewise, the lowest fruit yield (26.650 t/ha) was recorded in the 0 t/ha treatment. Yield increased significantly with compost levels, peaking at 36.437 t/ha in the 12CO+3PODS treatment.

IV. Conclusion

The study’s findings highlight the potential of sustainable agricultural practices to enhance watermelon production. The positive impacts of cow dung and poultry droppings (COPODs) on vine length, number of leaves, fruit weight, and fruit yield underscore the importance of organic inputs in promoting plant growth and development. Moreover, the study's results on plant spacing demonstrate the significance of optimizing planting practices to maximize resource utilization and minimize competition among plants, leading to improved crop performance. While the variety of watermelon had a relatively minor impact on the studied parameters, further research could explore the interactions between variety and other factors, such as COPOD levels and spacing, to identify specific combinations that may yield even greater benefits. Additionally, investigating the long-term effects of COPODs on soil health and the potential of other organic fertilizers could provide valuable insights for sustainable watermelon cultivation. Overall, the study's findings contribute to a growing body of evidence supporting the integration of organic practices in agriculture. By optimizing the use of COPODs and plant spacing, farmers can enhance watermelon production, improve soil health, and reduce reliance on synthetic inputs, ultimately contributing to more sustainable and resilient agricultural systems.

References

[1] Ban, D., Goreta, S And Borosic, J (2006). Plant Spacing And Cultivar Affect Melon Growth And Yield Components. Scientia Horticuturea. 109 (3): 238-243.
[2] Bolin, P. And L. Brandenberger (2001). Cucurbit Integrated Crop Management. Oklahoma
[3] Cooperative Extension Service E-853. Oklahoma State Univ., Stillwater, Okla.
[4] Clough, G. H (1992). Increase Yields With Intensive Watermelon Production. Amer. Veg.
[5] Grower. 40:74-76.
[6] Dantata, I.J (2008). Cucumber Production In Semi-Arid Zone Of Nigeria As Influenced By Organic Sources Of Mineral Nutrition. Proceedings Of The 26th Annual Conference Of The Horticultural Society Of Nigeria (Hortson) Held At Adamawa State University, Mubi, Nigeria On 26-30 October 2008. Pp 201- 204.
[7] Dantata, I.J (2014). Assessing Watermelon Cultivars Under Different Planting Distances In Bauchi North, Nigeria. Asian Journal Applied Science. 2(3): 381-386
[8] Dantata, I.J And Babatunde, F.E (2013).Productivity Of Cucumber In A Semi-Arid Savanna Of Nigeria As Affected By Organic Fertilizer. Journal Of Applied Agricultural Research. 5 (2): 283 - 288.
[9] Dantata, I.J And Oseni, T.O (2009).Growth, Yield And Fruit Characteristics Of Tomato As Affected By Nitrogen. Biological And Environmental Sciences Journal For The Tropics.6(4):43- 46.
[10] Dantata, I.J., Babatunde, F.E., Mustapha, S And Fagam, A. S (2010). Influence Of Variety And Plant Spacing On Tuber Size, Tuber Shape And Fresh Marketable Yield Of Sweet Potato In Bauchi, Nigeria. Biological And Environmental Sciences Journal For The Tropics. 7 (3):140- 144.
[11] Duncan, D.B (1955).Multiple Range And Multiple F. Test. Biometrics 11: 1- 42.
[12] Fernandez-Bayon, J. M., J. D. Barnes, And J. H. Ollerenshaw (1993). Physiological Effects Of
[13] Ozone On Genotypes Of Watermelon (Citrullus Lanatus) And Muskmelon (Cucumis Melo) Widely Grown In Spain. Environ. Pollution. 81:199-206.
[14] Gimeno, B. S., V. Bermejo, R. A. Reinert, Y. B. Zheng, And J. D. Barnes (1999). Adverse Effects
[15] Of Ambient Ozone On Watermelon Yield And Physiology At A Rural Site In Eastern Spain. New Phytologist. 144:245-260.
[16] Fumagalli, I., B. S. Gimeno, D. Velissariou, L. De Temmerman, And G. Mills (2001). Evidence
[17] Of Ozone-Induced Adverse Effects On Crops In The Mediterranean Region. Atmospheric Environ.35:2583-2587.
[18] Gichimu, B.M., Owuor, B.O And Dida, M.M (2008). Agronomic Performance Of Three Most Popular Commercial Watermelon Cultivars In Kenya As Compared To One Newly Introduced Cultivar And One Local Landrace Grown On Dystric Nitisols Under Sub-Humid Tropical Conditions. Arpn J. Agri. Biol. Sci. 3: 65-71.
[19] Hernandez, P., Rodríguez, P., Galindo, P And Vázquez, A (2010). Post-Harvest Behavior Of Organically Fertilized Watermelon. Postharvest Biology And Technology. 55(1):107-112.
[20] Hochmuth, G. J., E. Kee, T. K. Hartz, F. J. Dainello, And J. E. Motes (2001). Chapter 5. Cultural
[21] Management, P. 78-97. In: D. N. Maynard (Ed.). Watermelons: Characteristics, Production, And Marketing. Ashs Press, Alexandria, Va.
[22] Korkmaz, A. And R. J. Dufault (2001). Developmental Consequences Of Cold Temperature Stress
[23] At Transplanting On Seedling And Field Growth And Yield. I. Watermelon. J. Amer. Soc. Hort. Sci.126:404-409.
[24] Kowal, J. M. And D. T. Knabe (1972). An Agroclimatological Atlas Of The Northern States Of Nigeria. Ahmadu Bello University Press, Zaria.
[25] Lu, W., J. V. Edelson, J. A. Duthie, And B. W. Roberts (2003). A Comparison Of Yield Between
[26] High And Low Intensity Of Crop Management For Three Watermelon Genotypes. Journal Of

[27] Vegetable Production (In Press).
[28] Nesmith, D. S (1993). Plant Spacing Influences Watermelon Yield And Yield Components.
[29] Hortscience. 29:885-887.
[30] Robinson, R. W. And D. S. Decker-Walters (1997). Cucurbits. Crop Production Science In
[31] Horticulture Series 6. Cab International, New York, N.Y.
[32] Schippers, R.R (2000). African Indigenous Vegetables. An Overview Of The Species. N.R/Aco. Eu, 2000: Pp 56-60.
[33] Scott, W. D., B. D. Mccraw, J. E. Motes, And M. W. Smith (1993). Application Of Calcium To
[34] Soil And Genotype Affect Elemental Concentration Of Watermelon Leaf And Rind Tissue.
[35] J. Amer. Hort. Sci. 118:201-206.
[36] Snyder, R. G., J. E. Simon, And R. A. Reinert (1991). Effects Of Air Quality On Growth, Yield, And
[37] Quality Of Watermelon. Hort Science. 26:1045-1047.
[38] Steel, R.G.D. And Torrie, J.H. (1980). Principles And Procedures Of Statistics, 2nd Edition, Mcgraw-Hill Book Co., Inc., New York.
[39] Taylor, M.J., Wenhua, Lu., James, A., Duthie, B., Warren, R., Jonathan, V. E (2003). Effects Of High And Low Management Intensity On Profitability For Three Watermelon Genotypes
[40] Paper Presented At The Evaluation Of Production Alternatives 1session Of The Southern Agricultural Economics Association. Annual Meeting, Mobile, Alabama, February 1-5, 2003
[41] Spss (1996). Statistical Package For Social Sciences. Spss/Stat Version 7.5 For Windows.
[42] Watanabe, S., Y. Nakano, And K. Okano (2001). Relationships Between Total Leaf Area And Fruit
[43] Weight In Vertical And Horizontal Trained Watermelon [Citrullus Lanatus (Thunb.)
[44] Matsumet Nakai] Plants. J. Japan Soc. Hort. Sci. 70: 725-732.

Table 1: Effect of COPODs, spacing and variety on vine length (cm) of watermelon at 5-11 weeks after sowing in Gashua during the 2016/17 dry season

Treatments	Vine length (cm)						
	Weeks after sowing						
	5	6	7	8	9	10	11
COPODS (t/ha)							
0	26.547b	32.641b	49.141b	56.781b	62.672b	74.047b	81.219b
4CO+1PODS	29.266ab	38.109a	55.391a	62.609a	68.391a	82.469a	88.375ab
8CO+2PODS	29.672ab	38.172a	57.016a	65.641a	71.203a	86.875a	93.672a
12CO+3PODS	31.047a	41.156a	59.641a	67.016a	73.031a	89.469a	95.531a
LS	*	*	*	*	*	*	*
SE±	0.995	1.016	1.498	1.675	1.736	2.042	2.644
Spacing (cm)							
25	24.266c	34.094b	51.203b	58.672b	65.219a	78.875b	80.516b
50	29.437b	37.250ab	55.703ab	62.781ab	68.828a	82.000ab	90.859a
75	30.047ab	39.359a	56.500a	64.531a	69.813a	84.469ab	91.938a
100	32.781a	39.375a	57.781a	66.062a	71.438a	87.516a	95.484a
LS	*	*	*	*	*	*	*
SE±	0.995	1.016	1.498	1.675	1.736	2.042	2.644
Variety							
Koalack	29.984	38.625	57.875	65.734	71.734	86.219	93.547
Sugar baby	29.563	37.625	55.406	63.031	68.875	83.031	89.297
Royal sweet	29.000	37.578	54.516	62.031	67.547	82.219	88.922
Paradise	27.984	36.250	53.391	61.250	67.141	81.391	87.031
LS	NS	NS	NS	NS	NS	NS	NS
SE±	0.995	1.016	1.498	1.675	1.736	2.042	2.644
Interactions							
CPDS* Spac	*	NS	NS	NS	NS	NS	NS
CPDS* Var	NS	NS	NS	NS	NS	NS	NS
Spac* Var	*	NS	NS	NS	NS	NS	NS
C* Spac* Var	NS	NS	NS	NS	NS	NS	NS

In a column, means followed by same letter are not significantly different at 5% probability level by DMRT
LS. Level of significant *Significant NS. Not significant SE± Standard error of the difference

Table 2: Interaction between COPODs and spacing (cm) on vine length (cm) of watermelon at 5 weeks after sowing in Gashua during the 2016/17 dry season

Treatments	Vine length (cm)			
	5 Weeks			
	Spacing (cm)			
	25	50	75	100
COPODS (t/ha)				
0	19.938e	25.500cd	28.937bc	31.813ab
4CO+1PODS	23.250de	28.500bc	29.313bc	32.813ab
8CO+2PODS	25.375cd	28.563bc	30.438abc	34.812a
12CO+3PODS	28.062bcd	30.875ab	32.750ab	35.187a
SE±	1.990			

In a column, means followed by same letter are not significantly different at 5% probability level by DMRT

SE± Standard error of the difference

Table 3: Interaction between spacing (cm) and variety on vine length (cm) of watermelon at 5 weeks after sowing in Gashua during the 2016/17 dry season

Treatments	Vine length (cm)			
	5 Weeks			
	Variety			
	Koalack	Sugar baby	Royal sweet	Paradise
Spacing (cm)				
25	27.938cd	27.938cd	24.625de	20.500e
50	32.313abc	31.125abc	28.812bcd	25.250de
75	32.000abc	31.313abc	29.187cd	24.750de
100	35.000a	34.687a	33.500ab	27.187cd
SE±	1.990			

In a column, means followed by same letter are not significantly different at 5% probability level by DMRT
SE± Standard error of the difference

Table 4: Effect of COPODs, spacing and variety on number of leaves of watermelon at 5, 6, 7, 8, 9, 10 and 11 weeks after sowing in Gashua during the 2016/17 dry seasons

Treatments	Number of leaves						
	Weeks after sowing						
	5	6	7	8	9	10	11
COPODS (t/ha)							
0	18.812b	23.297b	28.641c	38.844b	49.375b	63.141b	76.172c
4CO+1PODS	20.953ab	26.219a	32.609b	46.656a	59.719a	74.594a	86.937bc
8CO+2PODS	22.453a	26.578a	34.922ab	49.953a	60.937a	77.625a	92.875ab
12CO+3PODS	22.938a	27.688a	36.609a	49.953a	65.141a	81.750a	94.422a
LS	*	*	*	*	*	*	*
SE±	0.787	0.674	1.078	2.012	2.561	2.665	2.707
Spacing (cm)							
25	18.906c	23.625c	31.359b	40.422b	52.094b	65.703b	82.438a
50	20.516bc	25.438bc	31.750ab	44.859ab	56.313ab	73.578ab	83.406a
75	22.641ab	26.953ab	34.781ab	46.672ab	62.250a	78.141a	91.109a
100	23.094a	27.766a	34.891a	51.391a	64.516a	79.687a	93.453a
LS	*	*	*	*	*	*	*
SE±	0.787	0.674	1.078	2.012	2.561	2.665	2.707
Variety							
Koalack	22.547	27.094a	34.531	48.312	62.516	77.625	90.906
Sugar baby	21.578	26.062a	33.859	46.141	58.844	74.188	87.250
Royal sweet	20.781	25.781a	32.281	44.797	57.250	72.656	86.328
Paradise	20.250	24.844a	32.109	44.094	56.563	72.641	85.922
LS	NS	*	NS	NS	NS	NS	NS
SE±	0.787	0.674	1.078	2.012	2.561	2.665	2.707
Interactions							
CPDS* Spac	NS	NS	NS	NS	NS	NS	NS
CPDS* Var	NS	NS	NS	NS	NS	NS	NS
Spac* Var	NS	NS	NS	*	*	*	*
C* Spac* Var	NS	NS	NS	NS	NS	NS	NS

In a column, means followed by same letter are not significantly different at 5% probability level by DMRT
LS. Level of significant *Significant NS. Not significant SE± Standard error of the difference

Table 5: Interaction between variety and spacing (cm) on number of leaves of watermelon at 8, 9, 10 and 11 weeks after sowing in Gashua during the 2016/17 dry season

Treatments	Number of leaves			
	8 Weeks			
	Spacing (cm)			
	25	50	75	100
Variety				
Koalack	43.812defg	53.625abc	56.250ab	59.750a
Sugar baby	41.000efg	43.500defg	47.750bcde	51.375abcd
Royal sweet	40.875efg	41.250efg	45.563cdef	51.000abcd
Paradise	36.000g	37.125fg	41.063efg	43.437defg
SE±	4.024			
	9 Weeks			
Koalack	55.312cde	66.562abc	72.750ab	74.000a
Sugar baby	54.750cde	55.625cde	65.375abc	65.812abc
Royal sweet	52.313de	52.875de	60.250cd	61.125bcd
Paradise	46.000e	50.187de	50.625de	57.125cde

SE±	5.123			
	10 Weeks			
Koalack	72.438defg	85.500abc	89.125ab	91.688a
Sugar baby	67.375efg	69.687defg	78.625bcde	80.687abcd
Royal sweet	65.687fg	68.562defg	76.313cdef	78.312bcdef
Paradise	60.062g	66.437efg	67.812efg	70.125
SE±	5.330			
	11 Weeks			
Koalack	84.31bcd	93.69ab	101.00a	102.87a
Sugar baby	84.06bcd	93.19ab	92.44ab	93.19ab
Royal sweet	78.44cd	84.13bcd	82.88bcd	91.06abc
Paradise	75.31d	79.94bcd	80.56bcd	84.56bcd
SE±	5.413			

In a column, means followed by same letter are not significantly different at 5% probability level by DMRT
SE± Standard error of the difference

Table 6: Effect of COPODs, spacing and variety on fruit weight (kg) and fruit yield (t/ha) of watermelon in Gashua during the 2016/17 dry season

Treatments	Fruit weight (kg)	Fruit yield (t/ha)
COPODS (t/ha)		
0	19.039	26.650
4CO+1PODS	21.720	31.194
8CO+2PODS	22.958	35.013
12CO+3PODS	24.869	36.437
LS	*	*
SE±	0.420	0.784
Spacing (cm)		
25	18.589b	28.091b
50	19.267b	28.312b
75	25.220a	35.706a
100	25.509a	37.194a
LS	*	*
SE±	0.420	0.784
Variety		
Koalack	22.856	32.838
Sugar baby	22.184	32.663
Royal sweet	22.019	32.394
Paradise	21.527	31.400
LS	NS	NS
SE±	0.420	0.784
Interactions		
CPDS* Spac	*	*
CPDS* Var	NS	NS
Spac* Var	*	*
C* Spac* Var	NS	NS

In a column, means followed by same letter are not significantly different at 5% probability level by DMRT
LS. Level of significant *Significant NS. Not significant SE± Standard error of the difference

Table 7: Interaction between COPODs and spacing (cm) on fruit weight (kg) and fruit yield (t/ha) of watermelon in Gashua during the 2016/17 dry season

Treatments	Fruit weight (kg)				Fruit yield (t/ha)			
	Spacing (cm)				Spacing (cm)			
	25	50	75	100	25	50	75	100
COPODS (t/ha)								
0	17.619 d	18.356 d	18.375d	18.494d	21.750c	22.050c	28.600b	28.950b
4CO+1PODS	19.250d	19.319d	19.887d	20.125cd	29.900b	29.900b	30.325b	31.300b
8CO+2PODS	23.956 b	23.969b	25.062ab	25.269ab	32.700b	32.825b	32.900b	39.800a
12CO+3PODS	25.281ab	25.487ab	26.000ab	27.894a	40.300a	41.32a5	33.100b	41.450a
SE±	0.839				1.568			

In a column, means followed by same letter are not significantly different at 5% probability level by DMRT
SE± Standard error of the difference

Table 8: Interaction between variety and spacing (cm) on fruit weight (kg) and fruit yield (t/ha) of watermelon in Gashua during the 2016/17 dry season

Treatments	Fruit weight (kg)				Fruit yield (t/ha)			
	Spacing (cm)				Spacing (cm)			
	25	50	75	100	25	50	75	100

Variety								
Koalack	23.969c	25.281bc	26.000abc	27.894 a	62.400abc	62.675ab	63.575ab	66.825a
Sugar baby	19.319d	25.062bc	25.269bc	25.487abc	51.634d	57.700c	60.325bc	60.600bc
Royal sweet	18.356d	18.494d	19.250d	23.956c	45.750e	46.225e	46.425e	48.050e
Paradise	17.619d	18.375d	19.887d	20.125d	43.725e	44.400e	45.000e	45.550e
SE±	0.839				1.568			

In a column, means followed by same letter are not significantly different at 5% probability level by DMRT
SE± Standard error of the difference

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