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Research Article

Weed interference and fruit yield of Chilli Pepper (*Capsicum Annum*) as influenced by plant density

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Abstract

Plant spacing is one of the agronomic practices that influence crop growth and development. The influence of spacing on weed interference and fruit yield of *Capsicum annum* was evaluated at the Teaching Research farm, Lagos State Polytechnic, Ikorodu during 2019 planting season. Three treatment consisted of chilli pepper transplanted at 60cm x 60cm, 60cm x 45cm and 60cm x 35cm replicated three times in a Randomized Complete Block Design (RCBD). Parameters tested were, Weed Cover Score (WCS), Weed Density (WD), Weed Fresh Weight (WFW), Plant Height (PH), Stem Girth (SG) and number of leaves at 3, 6 and 9 (WAT), number of days to 50% flowering, number of fruits per plot and fruit yield. Result showed that, plant density significantly affected the yield of pepper. Pepper transplanted at 60cm x 45cm gave highest yield (124kg/ha^{-1}) and moderate weed suppression, as against 60cm x 60cm and 60cm x 35cm which recorded 36.96kg/ha^{-1} and 32,49 kg/ha^{-1} respectively. It is therefore recommended that farmers in Ikorodu should adopt 60cm x 45cm for growing chilli pepper.

Introduction

Chilli pepper (*Capsicum annum* L) is a highly important remunerative spice widely grown for its fruit, which are used in green as well as ripe dried form for pungency. Capsicum attained a status of high value and low volume crop in many tropical and subtropical countries in recent years and occupies a place of pride among vegetables in many cuisine, due to its delicacy and pleasant flavour coupled with rich content of ascorbic acid along with other vitamins and minerals [1].

Peppers cultivation in the field are subject to biotic and abiotic factors effects that influence the yield. Some of the factors that negatively affect crop growth, development and yield is the plant density, presence of weeds and low soil fertility [2]. Chilli pepper culture is extremely susceptible to the interference of these plants because it presents slow initial growth and low index of leaf area in relation to it [3].

Plant population can influence crop growth by pest interactions. For instance, closer plant spacing may give crops competitive advantage over weeds or provide ecological weed control. A key component of alternative approaches to weed management (other than chemical control) is the enhancement of crop competitiveness against weeds [4]. Manipulating agronomic factors such as row and plant spacing may provide a non-chemical means of reducing the impact of weeds interference on crop yields [5]. Smaller row spacing may discourage colonization by certain insects or reduce percentage of insect damaged plants. Also, closer rows and higher plant populations reduced evaporation, increased efficiency of water use and gave higher growth and yields by increasing the energy available to the crop [6]. Optimum plant spacing ensures proper growth and development of plant resulting in maximum yield of crop and economic use of land. Yield of sweet pepper has been reported to be dependent on the number of plants accommodated per unit area of land [7].

A large majority of farmers in South-West Nigeria who engage in the pepper production experience low returns on investment caused by low yields occasioned by low or too much planting density [8]. Thus, they lack an understanding of the standard spacing, to give optimum density that needs to be adopted to suppress weeds while improving performance and yield of the crop. This study is therefore important because it will enable farmers to identify the best plant density required

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in pepper production that will ensure they achieve optimum yield while reducing weed interference considerably. This will lead to increased profits and lower costs of production.

Materials and methods

Experimental location and land preparation

The experiment was conducted on 90.2m² area of land at the Teaching and Research Farm, Lagos State Polytechnic, Ikorodu. (Latitude 6˚ 6'N and Longitude 3˚ 5'S) located in the humid tropical rainforest agro-ecological zone. The land was ploughed and harrowed to obtained a fine tilth, nine treatment plots of 3m x 2.4m dimension each were constructed with a discard area of 0.5m between the beds and replicates arranged in a Randomized Complete Block Design (RCBD) with three treatments (Treatment T1 – 60cm x 60cm (55, 555 plants / ha); Treatment T2 – 60cm x 45cm (37, 037 plants / ha) and Treatment T3 – 60cm x 35cm (27, 778 plants/ha) and replicated thrice.

Nursery, transplanting and management practices

The seeds of local chilli pepper were purchased from Sabo market, Ikorodu. The seeds were extracted according to standard procedures and air-dried. Thereafter, the seedlings were raised in nursery using well sterilized soil. Nursery management practices, such as shading, irrigation and weeding were carried out as at when due to ensure production of healthy seedlings. The transplanting was done in the cooler period of the day (evening) at five weeks after the nursery establishment when the seedlings are at 5 leaf stage [2].

Data collection and analysis

Five plants were randomly tagged for data collection in terms of weed interference, chill pepper growth and yield performances. Growth parameters and weed interference were collected on number of leaves, plant height, stem girth, weed cover score (wcs), weed density (no^{-m2}) and fresh weight (g) at 3, 6, and 9 Weeks After Transplanting (WAT) respectively [9]. Fresh weights of weeds harvested from each plot were recorded by weighing weeds collected with the aid of the 0.5m²quadrat from the treatment plots. To assess weed density, a 0.5m² quadrat was used and three assessments per plot were made on each occasion. Then the number of weeds in the portion where the quadrat was placed in the plot represented the weed density in each plot. Weed cover score was obtained by visual observation of prevalence of weeds on the plots and scores ranging from 0 to 10 were assigned (0 implies zero weeds on the field, 1 implies sparse weed coverage, 2 implies intermediate). Number of days to 50% flowering, yield parameters were collected on number of harvested fruits and fruit yield was determined based on the weight of fruits harvested per plot. Data collected were subjected to analysis of Variance (ANOVA) and significant treatment means were subjected to Duncan Multiple Range Test (DMRT) at 5% probability.

Results and Discussion

Effects of plant density on weed interference in Chilli pepper production

Results presented in Table 1 shows that different spacing of chilli pepper did not significantly (p≥0.05) affected weed cover score, fresh weed weight and weed density at 3, 6 and 9 WAT. At 9 WAT, 60cm x 60cm spacing had the highest weed fresh weight (0.11g) followed by 60cm x 45cm (0.08g) and 60cm x 35cm (0.07g). The result shows that, weed density increases as plant density decreases, except at 9WAT. It is hypothesized that the negative relationship between the weed density and the plant density is as a result of more spaces for weed to grow due lower plant densities occasioned by wider spacing used. This is in agreement with Pant (2009) who found out that fresh weed weight of site planted with hot pepper, weed density increases as plant density decreases. The level of weed infestation in each plot was not different from each other despite the spacing used. The reason might be due to the fact that chilli pepper has a big canopy which has the tendency to smother the undergrowth. From the result of this experiment, it shown that fresh weed weight increases as plant density decreases, this is in disagreement with Pitelli (2008) who found out that fresh weed weight of site planted with hot pepper increases as plant density increases.

Effects of plant density on Chilli pepper growth performances and numbers of days to 50% flowering

Table 2, shows that plant height, number of leaves and stem girth were not significantly (p≥0.05) affected by different plant density at 3, 6 and 9 WAT. However, taller plants were recorded in 60cm x 60cm plots with high densities than transplanting at

Table 1: Effects of plant density on weed cover score, fresh weigh and weed density on chilli pepper at Ikorodu.

Treatments	weed cover score			weed fresh weight			weed density		
	Weeks after transplanting (WAT)								
	3	*6*	*9*	*3*	*6*	*9*	*3*	*6*	*9*
60cm x 60cm	7.00	5.33	5.33	0.46	0.46	0.11	64.67	56.00	51.33
60cm x 45cm	5.67	6.33	6.00	0.68	0.22	0.08	90.33	61.33	68.00
60cm x 35cm	7.00	5.67	5.00	0.85	0.17	0.07	97.67	63.00	62.33
F-Test	ns	ns	ns	ns	ns	ns	ns	ns	ns
SE	1.11	4.44	0.94	0.10	0.01	0.01	437.94	297.11	276.78

ns – non significant; **- significant at 1% level of probability; SE: Standard Error

Table 2: Effects of plant density on Chilli pepper growth performances and numbers of days to 50% flowering at Ikorodu.

Treatments	No of leaves			Stem girth			plant height			days to 50% flowering
	Weeks after transplanting (WAT)									
	3	*6*	*9*	*3*	*6*	*9*	*3*	*6*	*9*	
60cm x 60cm	30.17	38.96	44.53	1.75	3.97	6.04	19.36	24.76	34.91	39.33a
60cm x 45cm	20.42	36.52	39.00	1.89	3.74	5.41	15.50	24.54	34.07	26.33b
60cm x 35cm	22.58	36.18	43.81	1.84	2.63	4.90	14.51	21.35	28.98	36.67a
F-Test	ns	ns	ns	ns	ns	ns	Ns	ns	ns	**
SE	47.18	71.65	57.68	0.18	0.35	0.54	18.84	35.23	7.62	4.61

ns – non-significant, **- significant at 1% level of probability, SE: Standard Error

Means in a column followed by different alphabet(s) are significantly different at 5% significant level using Duncan Multiple Range Test (DMRT).

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60cm x 35cm. This could be due to the fact that the high density of pepper plant resulted in individual plants competing to tap sunlight and thereby growing vertically. A lower density of plant at 60cm x 35cm produced plant of thicker stem than the high density of 60cm x 60cm. This was because the plant under the treatment plot has more space, nutrition, and moisture to absorb which led to thickness of the stem girth.

The non-significant response of growth components obtained due to the different spacing showed that number of leaves in plants is a genetic factor, that is, irrespective of the available space and nutrients for plants, it will not have more than the required number of leaves. Plant spacing ranging from 35 cm to 60cm agreed with findings of Salau, et al. [10] who identified non-significant intra row response in hot pepper (*Capsicum frutescens* L).

Number of days to 50% flowering was significantly ($p \leq 0.01$) affected by plant density (Table 2). Pepper transplanted at 60cm x 45cm flowered earlier (26.33days) than the two other treatments, 60cm x 60cm (39.33days) and 60cm x 35cm (36.67days) which were not significantly different from each other. This is in agreement with Ayeni [11] who found out that 50% flowering of hot pepper was significantly affect by plant density.

Effects of plant density on yield attributes of chilli pepper

Number of fruits and fruit weight was significantly affected by plant density at $p \leq 0.01$ and $p \leq 0.05$ respectively (Table 3). Plots with 60cm x 45cm spacing had the highest yield of 24.50 harvested pepper fruits and 124.18kg/ha pepper fruit weight respectively followed by 60cm x 60cm (13.33 fruits and 36.96kg/ha) and 60cm x 35cm had least yield of 13.33 harvested fruits and 56.00kg/ha weight of pepper fruits. This result may be due to less weed infestation noticed in plots with higher plant density which reduces weed competition. This result is in line with the findings of Peil, et al. [12] that plots with higher plant densities had good yield than those with lower plant density in hot pepper and the result is in disagreement with [12] who found out that number of fruit increases with decrease in plant density.

Table 3: Effects of plant density on yield attributes of Chilli pepper at Ikorodu.

Treatments	Number of fruits	Yield (kg/ha)
60cm x 60cm	13.33b	36.96b
60cm x 45cm	24.50a	124.18a
60cm x 35cm	7.67c	32.49b
F-Test	**	*
SE	9.78	94.16

* - significant at 5% level of probability, ** - significant at 1% level of probability

Means in a column followed by different alphabet(s) are significantly different at 5% significant level using Duncan Multiple Range Test (DMRT).

Conclusion

Result obtained from the study showed that plant density significantly affected yield of pepper. Pepper transplanted at 60cm x 45cm gave a yield of 124 kg/ha and moderate weed suppression as against that of 60cm x 60cm and 60cm x 35cm which recorded 36.96 kg/ha and 32,49 kg/ha respectively. It is therefore recommended that farmers in Ikorodu agro ecological zone should adopt a density of 37,037 plants/ha (60cm x 45cm) when growing chilli pepper.

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