

EFFECTS OF PLANTING DATE AND PERIOD OF WEED CONTROL ON THE GROWTH AND YIELD OF COTTON IN SAMARU, ZARIA

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Abstract

A field trial was conducted during the 2013 - 2014 cropping seasons at the Teaching and Research Farm of Samaru College of Agriculture, Ahmadu Bello University. Zaria located between latitude 11°11'N and longitude 7°38'E in the Northern guinea savannah ecological zone of Nigeria at an altitude of 686m above sea level. The land was ploughed, harrowed and pulverized with a hand hoe to make the soil level smooth and suitable for seed germination and establishment. The trial was laid out in a randomized complete block design (RCBD) with treatment combinations of 7th May, 7th June, 7th July, 7th August, of 2013 - 2014 and weed control of 0, 3, 6 and 9 weeks after sowing (WAS), replicated three times to give a total of 16 sub plots. From the results, it was observed that planting cotton first week June of every year and weeding once at 3 and 6 weeks after sowing will improve the performance of the crop in terms of growth and yield in Samaru, Zaria. Therefore, farmers are advised to abide by this recommendation.

Keywords: Cotton, planting date, weed control, growth, and yield

Introduction

Cotton (*Gossypium hirsutum*, L.) is the major cash crop in the tropics and sub-tropics of the world (Baylan et al., 2007). In Nigeria cotton is one of the most important cash crops apart from groundnut, oil palm, cocoa etc. Cotton is produced a wide range of fibre length, ranging from the extra-long to short staple cotton (Anjum et al., 2007). Long and medium staple types are usually produced under both irrigation and rain-fed conditions. Cotton requires 4 to 5 months of warm temperature (about 32°C) during the growing season (Anjum et al., 2007). Although cotton is grown under a wide range of annual precipitations, the amount and

distribution of rainfall is a limiting factor in its production (Anjum et al, 2007). The crop can be produced on a wide variety of soils ranging from sandy soil, sandy loam and loamy soils (Anjum et al, 2007). The attainment of the yield potential is often limited by poor cultural practices such as sowing date, plant spacing, plant population, weed control and mineral nutrition (Baylan et al, 2007). Cotton is a member of the family *Malvaceae*; cotton is a perennial plant, but when cultivated, it is treated as an annual plant (Anjum et al, 2007). There are over thirty wild and cultivated species of cotton (Baylan et al, 2007). The cultivated shrub plants grow up to 1-2 metres in height (Baylan et al, 2007). The world leading producers of

cotton are; China, United States of America, India, Pakistan, Uzbekistan, Brazil, Turkey, Australia, Turkmenistan and Egypt (Baylan et al, 2007). Ekwu and Nwokwu (2012) reported that the earliest planting date (15th, May) produced the tallest and most profusely branched plants of 13.79cm, highest number of leaves of 31.68, highest number of pods of 22.91 and length of pods of 16.09cm of okra. The 15th, July sowing gave the least values in all the vegetative parameters measured except plant height and number of days to 50% flowering. Ayoub and Afrah (2014) reported that late sowing of 20th, July and 10th, August had significant negative effects on both vegetative growth and seed yield of both cultivars in both years. The best vegetative growth and seed yield were obtained at 1st of July on okra. Shujat et al. (2006) evaluated the response of okra (*Abelmoschus esculentus* L. Moench.) cultivars to different sowing times and observed that maximum number of picking (27.80), number of pods plant⁻¹ (26.22), fruit diameter (1.46cm), plant height (1.48m), and yield hectare⁻¹ (14.57 tons) was recorded in cultivar Malav- 27, when sown on 28th May, 2005. Minimum days to emergence (10.93) and days to first picking (75.60) was observed when different okra cultivars sown on 8th June, 2005, whereas the minimum days to emergence (10.89) were observed in cultivar Malav-27 and minimum days to first picking (75.56) was recorded in cultivar Punjab selection. Ijoyah and Jimba (2011) reported that the greatest intercrop yields of sweet potato and okra were obtained when both crops were planted at the same time using the raised flattened top bed planting

method; therefore they observed that planting of both crops should be done at the same time using the ridge planting method. Ijoyah (2010) reported that okra yield was observed to reduce as sowing date advanced. The yield produced from the late June sowing was significantly (P_{205}) greater by 12.3 % and 11.1 % respectively, in 2008 and 2009 compared to that obtained from the mid-July sowing and by 22.8 % and 25.9 % respectively, in 2008 and 2009 compared to that produced from the early August sowing. El-Warakly (2014) reported that okra plants cultivated in mid-April produced the highest mean values of vegetative growth in comparison with the other sowing date. However, okra seeds which sowing in mid-May caused more earliness of flowering, in both seasons. It was also noticed that, okra plants cultivated in mid-April produced the highest mean values of seed yield and its components, i.e. number of pods plot⁻¹, number of seeds pod⁻¹, seed yield plot⁻¹, weight of 100-seeds, pod weight and seed germination percentage. Moniruzzaman et al. (2007) reported that 15 April sowing gave the highest seed yield of 3.13 tons ha⁻¹ closely followed by with the same sowing time of 3.06 tons ha⁻¹ of okra. The seed yield did not decline in 15 March sowing. Chattopadhyay et al. (2011) reported that the maximum matured pods plant⁻¹ of 14.57 and the longest matured pod of 18.00 cm were observed from 1st April sowing which was statistically similar with that of number and length recorded between 16th February and 1st May sowing date in okra. Kolo et al (2012) studied the influence of planting date and weed management practice on weed

emergence, growth, and yield of maize (*Zea mays* L.) in southern guinea savannah of Nigeria during the 2008 and 2009 growing seasons in Nigeria observed that weed seedling emergence was affected by date of planting in an inconsistent manner, a higher number of weed species were encountered in plots established on the first planting date 2 July while plots established on the last date of planting 13 August had the least number of weed species. Date of planting and weed control practice significantly affected maize grain yield and 100-seed weight, grain yield declined with delay in planting date. Maize growth likely contributes to the crop having a distinct competitive advantage over weeds when planted in early July, compared with late July and August plantings. Weeds have been defined as higher plants in the Agro-ecosystem which are not sown, undesired, out of place or generally as plants which do more harm than good (Baylan *et al*, 2007). They lead to direct yield losses through competition with the crop for water, nutrients, light, space and carbon dioxide (Baylan *et al*, 2007). The degree of damage is mainly a function of their number, biomass and leaf area index as compared with that of the crop (Baylan *et al*, 2007). Weeds have different competitive abilities, which determine their performance and potential of damage in given situations; most important are vigor, growth habit, seed production, regenerative capacities and time of germination (Baylan *et al*, 2007). In addition to competition, weeds can interfere negatively with cultural and harvest practices and may be poisonous and harbour pests and diseases (Baylan *et al*, 2007; Kamara *et*

al, 2007). The present study was carried out to find out the optimum planting date and period of weed control for the improvement in growth and yield of cotton.

Materials and Methods

A field trial was conducted during the 2013 - 2014 cropping seasons at the Teaching and Research Farm of Samaru College of Agriculture, Ahmadu Bello University, Zaria located between latitude 11°11'N and longitude 7°38'E in the Northern guinea savannah ecological zone of Nigeria at an altitude of 686m above sea level. The land was ploughed, harrowed and pulverized with a hand hoe to make the soil level smooth and suitable for seed germination and establishment. The trial was laid out in a randomized complete block design (RCBD) with treatment combinations of 7th May, 7th June, 7th July, 7th August, of 2013 - 2014 and weed control of 0, 3, 6 and 9 weeks after sowing (WAS), replicated three times to give a total of 16 sub plots. The total plot size was 10 x 5 m = 50 m². Seeds of okra were sown on 7th May; 7th June; 7th July and 7th August, of 2013 - 2014 cropping seasons. Sowing was done using a hand hoe at the rate of three seeds hole⁻¹ and later thinned to two seedlings stand⁻¹ at an inter and intra- row spacing of 50 cm respectively, during the first weeding three weeks after sowing. Weed control began at 0, 3, 6 and 9 weeks after sowing as treatments. Means Plant height (cm), number of leaves plant⁻¹, number of branches plant⁻¹, leaf area index plant⁻¹, number of flowers plant⁻¹, boll yield (g) plant⁻¹, seed yield plant⁻¹ and lint yield (kg) ha⁻¹. All data collected was analysed statistically using mixed model procedure

of statistical analysis system (SAS) software version 8. Means were compared using the least significant difference (LSD) at

5% level of probability (Rangaswamy, 2010).

RESULTS

Table 1 show that the mean physical properties of the soil in 2013 - 2014 cropping season was sandy-loam with high proportion of sand, low silt and clay. The chemical analysis revealed that the soil contains low amount of organic carbon, pH in water, total nitrogen, total phosphorus, potassium, magnesium, sodium, calcium and cation exchange capacity.

Plant height (cm)

Table 2 shows that there was a significant difference ($P < 0.05$) between treatment means due to planting date on plant height of cotton. The mean Planting date of 7th May, 2013 - 2014 significantly gave a higher mean value on plant height of cotton, which was followed by mean planting date of 7th June, 2013 - 2014, which was also followed by mean planting date of 7th July, 2013 - 2014, whereas mean planting date of 7th August, 2013 - 2014 significantly gave the lowest mean value on plant height of cotton among the treatment means. There was also a significant difference ($P < 0.05$) observed among the treatment means due to the period of weed control on plant height of cotton. Weeding cotton once at 3 and 6 WAS significantly gave a higher mean value, which was followed by weeding once at 6 and 9 WAS, which was also followed by the control and weeding once at 9WAS which were not significantly

different ($P > 0.05$) from each other.

Number of leaves plant⁻¹

Table 2 shows that there was a significant difference ($P < 0.05$) between treatment means due to planting date on the number of leaves plant⁻¹ of cotton. mean Planting date of 7th May, 2013 - 2014 significantly gave a higher mean value on the number of leaves plant⁻¹ of cotton, which was followed by mean planting date of 7th June, 2013 - 2014, which was also followed by mean planting date of 7th July, 2013 - 2014, whereas mean planting date of 7th August, 2013 - 2014 significantly gave the lowest mean value on the number of leaves plant⁻¹ of cotton among the treatment means. There was also a significant difference ($P < 0.05$) observed among the treatment means due to the period of weed control on the number of leaves plant⁻¹ of cotton. Weeding cotton once at 3 and 6WAS significantly gave a higher mean value, which was followed by weeding once at 6 and 9WAS, which was also followed by weeding once at 9WAS and lastly the control which gave the least mean value on the number of leaves plant⁻¹.

Number of branches plant⁻¹

Table 2 shows that there was a significant difference ($P < 0.05$) between treatment means due to planting date on the number of branches plant⁻¹ of cotton. mean Planting date of 7th May, 2013 - 2014 significantly gave a higher mean value on the number of branches plant⁻¹ of cotton, which was followed by mean planting date of 7th June, 2013 - 2014, which was also followed by mean planting date of 7th July, 2013 - 2014, whereas the mean planting date of 7th August, 2013 -

2014 significantly gave the lowest mean value on the number of branches plant⁻¹ of cotton among the treatment means. There was also a significant difference ($P < 0.05$) observed among the treatment means due to the period of weed control on the number of branches plant⁻¹ of cotton. Weeding cotton once at 3 and 6WAS significantly gave a higher mean value, which was followed by weeding once at 6 and 9WAS, which was also followed by weeding once at 9WAS and lastly the control which gave the least mean value on the number of branches plant⁻¹.

Leaf area index plant⁻¹

Table 2 shows that there was no a significant difference ($P > 0.05$) between treatment means due to planting date and the period of weed control on leaf area index of cotton.

Number of flowers plant⁻¹

Table 3 shows that there was a significant difference ($P < 0.05$) between treatment means due to planting date on the number of flowers plant⁻¹ of cotton. mean Planting date of 7th May, 2013 - 2014 significantly gave a higher mean value on the number of flowers plant⁻¹ of cotton, which was followed by mean planting date of 7th June, 2013 - 2014, which was also followed by mean planting date of 7th July, 2013 - 2014, whereas planting date of 7th August, 2014 significantly gave the lowest mean value on the number of branches plant⁻¹ of cotton among the treatment means. There was also a significant difference ($P < 0.05$) observed among the treatment means due to the period of weed control on the number of flowers

plant⁻¹ of cotton. Weeding cotton once at 3 and 6WAS significantly gave a higher mean value, which was followed by weeding once at 6 and 9 WAS, which was also followed by weeding once at 9 WAS which were not significantly different ($P > 0.05$) from each other. The control treatment significantly gave a lower mean value among the treatment means on the number of flowers plant⁻¹

Boll yield plant⁻¹

Table 3 shows that there was a significant difference ($P < 0.05$) between treatment means due to planting date on boll yield plant⁻¹ of cotton. mean Planting date of 7th May, 2013 - 2014 gave a higher mean value on boll yield plant⁻¹ of cotton, which was followed by mean planting date of 7th June, 2013 - 2014, also followed by mean planting date of 7th July, 2013 - 2014, followed by mean planting date of 7th August, 2013 - 2014 but were not significantly different from each. There was also a significant difference ($P < 0.05$) observed among the treatment means due to the period of weed control on the boll yield plant⁻¹ of cotton. Weeding cotton once at 3 and 6WAS significantly gave a higher mean value, which was followed by weeding once at 6 and 9WAS, which was also followed by weeding once at 9WAS and the control significantly gave the lowest mean value on boll yield plant⁻¹ of cotton.

Seed yield plant⁻¹

Table 3 shows that there was a significant difference ($P < 0.05$) between treatment means due to planting date on seed yield plant⁻¹ of cotton. Planting date of 7th May, 2013 - 2014 gave a higher

mean value on boll yield plant⁻¹ of cotton, which was followed by mean planting date of 7th June, 2013 - 2014, also followed by mean planting date of 7th July, 2013 - 2014, followed by mean planting date of 7th August, 2013 - 2014 but were not significantly different from each. There was also a significant difference ($P < 0.05$) observed among the treatment means due to the period of weed control on the seed yield plant⁻¹ of cotton. Weeding cotton once at 3 and 6WAS significantly gave a higher mean value, which was followed by weeding once at 6 and 9WAS, which was also followed by weeding once at 9WAS and the control significantly gave the lowest mean value on the seed yield plant⁻¹ of cotton.

Lint yield ha⁻¹

Table 3 shows that there was a significant difference ($P < 0.05$) between treatment means due to planting date on lint yield ha⁻¹ of cotton. mean Planting date of 7th May, 2013 - 2014 significantly gave a higher mean value on lint yield ha⁻¹ of cotton, which was followed by mean planting date of 7th June, 2013 - 2014, also followed by mean planting date of 7th July, 2013 - 2014, followed by mean planting date of 7th August, 2013 - 2014 cropping seasons. There was also a significant difference ($P < 0.05$) observed among the treatment means due to the period of weed control on the lint yield ha⁻¹ of cotton. Weeding cotton once at 3 and 6WAS significantly gave a higher mean value, which was followed by weeding once at 6 and 9WAS, which was also followed by weeding once at 9 WAS and the control which gave the lowest mean values on the lint yield ha⁻¹ of cotton but were not significantly

different from each.

Discussion

As observed from the results, it was evidenced that sowing cotton on 7th June, 2013 - 2014 significantly produced higher means of traits assessed such as plant height, number of leaves plant⁻¹, number of branches plant⁻¹, number of flowers plant⁻¹, boll yield plant⁻¹, seed yield plant⁻¹ and lint yield ha⁻¹, while sowing okra on of 7th August, 2013 - 2014 produced the lowest means of the same traits over the rest of the sowing dates. This is because there was adequate moisture in June that sustained the crop as against May when the moisture in the soil was not adequate enough to maintain plants in the field; thereby making them to perform poorly with respect to growth and yield during this period. Also, planting cotton late in August when the moisture was too much in the soil encouraged leaching of the available nutrients in the soil that might have been used by the crop growth and development thereby making them unavailable for the crop. Similar observations were earlier reported by Ekwu and Nwoku (2012) when they evaluated the effect of planting date on the growth and yield of okra (*Abelmoschus esculentus* L. Moench.) and observed that the earliest sowing date of 15th, May produced the highest number of leaves of 31.68, highest number of pods of 22.91 and length of pods of 16.09cm. The 15th, July sowing gave the least values in all the vegetative parameters measured except plant height and number of days to 50% flowering. Ayoub and Afrah (2014) observed that sowing date on okra (*Abelmoschus esculentus* L.

Moench.) late in 10th, August had significant negative effects on both vegetative growth and seed yield of both cultivars in both years. The best vegetative growth and seed yield were obtained at 1st of July. Accordingly, for high okra seed yield sowing on the first two weeks of July may be recommend for Khartoum State and areas of similar conditions. Shujat *et al.* (2006) reported that maximum number of picking of 27.80, number of pods plant⁻¹ of 26.22, fruit diameter of 1.46cm, plant height of 1.48m, and yield hectare⁻¹ of 14.57 tons was recorded in okra when sown on 28th May, 2005. Minimum days to emergence of 10.93 and days to first picking of 75.60 was observed when sown on 8th June, 2005.

Similar observations were reported by Tjoyah (2010) that early flowering and greater pod length, pod girth, number of pods plant⁻¹ and pod weight were recorded for the late June sowing. Okra yield was observed to reduce as sowing date advanced. The yield produced from the late June sowing was significantly greater at ($P < 0.05$) by 12.3 % and 11.1 % respectively, in 2008 and 2009 compared to that obtained from the mid-July sowing and by 22.8 % and 25.9 % respectively, in 2008 and 2009 compared to that produced from the early August sowing. This study showed that to maximize okra yield, the optimal sowing date would be late June for variety 'V-25'. El-Waraky (2014) also reported that okra plants cultivated in mid-April produced the highest mean values of vegetative growth in comparison with the other sowing date. However, okra seeds which were sown in mid-May caused more earliness of

flowering, in both seasons. It was also noticed that, okra plants cultivated in mid-April produced the highest mean values of seed yield and its components, that is number of pods plot⁻¹, number of seeds pod⁻¹, seed yield plot⁻¹, weight of 100-seeds, pod weight and seed germination percentage. However, plants cultivated in mid-March produced the lowest seed yield and its component, in both seasons. In the same vein, Dilruba *et al.* (2009) reported that sowing times of 6 April sowing produced the height yield 13.88 tons ha⁻¹, 22 March sowing produced the lowest yield of 10.22 tons ha⁻¹ They therefore recommended 06 April sowing as the best for better growth and yield of okra.

Also, Moniruzzaman *et al.* (2007) reported that the highest seed yield of 2.97 tons ha⁻¹ was recorded from 15 April sowing closely followed by 15 March sowing of 2.11 tons ha⁻¹ whereas the best quality seed was obtained from 16 February 88.7% germination and 29.75 seed vigour index and 15 March 83.7% germination and 28.80 seed vigour index sowing. 15 April sowing gave the highest seed yield of 3.13 tons ha⁻¹. Similar reports by Chattopadhyay *et al.* (2011) showed that the maximum matured pods plant⁻¹ of 14.57 and the longest matured pod of 18.00 cm were observed from 1st April sowing which was statistically similar with that of number and length recorded between 16th February and 1st May sowing date. However, seeds sown in 16th February significantly produced the highest mean seed yield of 6.84 kg ha⁻¹ followed by 1st March 6.18 kg ha⁻¹ sowing over the years. Seeds sown in either 16th February

or 1st March produced the best quality seed of 85.30 and 80.0% germination; 45.0 and 44.0 g test weight 29.75; 11.79 and 11.64 vigour index, respectively. Inconformity by Kolo et al. (2012) reported that weed seedling emergence was affected by date of planting in an inconsistent manner, a higher number of weed species were encountered in plots established on the first planting date 2 July while plots established on the last date of planting 13 August had the least number of weed species. Date of planting and weed control practice significantly affected maize grain yield and 100-seed weight, grain yield declined with delay in planting date. Maize growth likely contributed to the crop having a distinct competitive advantage over weeds when planted in early July, compared with late July and August plantings. However, Ogah (2013) indicated that African yam bean that was planted earlier in May produced greater tuber yields, which differed significantly ($P < 0.05$) from those that were planted later in each of the season. He then recommended that African yam bean be planted early in May of each season. The ideal planting date is the one that does not allow stages of crop growth to coincide with the period when the crop is very sensitive to temperature and moisture stress to avoid drastic effect on yield and quality (Ijoyah, 2010). Lu et al. (2001) found that final harvest index in taro was highest in January and March planting whereas July and September planting had the lowest harvest index, and that was attributed to high temperature during vigorous top growth stage from January and March crops and declining temperature during

the vigorous top growth stage for July and September crops.

Conclusion

Planting cotton on first week June of every year and weeding once at 3 and 6 WAS will improve the performance of the crop in terms of growth and yield in Samaru, Zaria. Therefore, farmers are advised to abide by this recommendation.

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Table 1: Physical and Chemical Properties of the Soil used for the Experiment during the 2014 Cropping Season in Samaru, Zaria

2014 Cropping Season

Mechanical composition Soil Depth

0-15cm

Sand % 86.77

Silt% 7.22

Clay% 11.26

Organic carbon% 5.44

pH in H₂O 6.48

Total nitrogen % 3.47

Available phosphorus mg kg⁻¹ 2.20

Available potassium mg kg⁻¹ 1.52

Available calcium mg kg⁻¹ 0.51

Available sodium mg kg⁻¹ 0.50

Available magnesium mg kg⁻¹ 1.31

Cation exchange capacity (CEC) mg kg⁻¹ 5.18

Table 2: Effects of Planting date and Period of Weed Control on the Growth of Cotton in Samaru, Zaria

Treatments	Plant height (cm) plant ⁻¹	Number of leaves plant ⁻¹	Number of branches	Leaf area index plant ⁻¹
Planting date 7 th May, 2013 – 2014	76.45a 68.68b 58.39c 45.88d	38.15a 33.34b 29.27c 25.68d	12.11a 9.91b 7.78c 5.92d	1.07a 1.05a 1.01a 0.91a
7 th June, 2013 - 2014 7 th July, 2013 - 2014 7 th August, 2013 - 2014				
LSD	4.00	2.45	1.55	NS
Period of weed control (WAS)				
0	47.14c	20.23c	5.18d	1.00a
3	67.26a	37.24a	10.67a	1.04a
6	54.38b	32.69b	8.80b	1.02a
9	46.34c	28.68d	6.58c	1.02a
LSD	3.14	2.88	0.90	NS
Interaction PD xPWC	NS	NS	NS	NS

Table 3: Effects of Planting date and Period of Weed Control on the Yield of Cotton in Samaru, Zaria

Treatments	Number of flowers plant ⁻¹	Boll yield plant ⁻¹	Seed yield plant ⁻¹	Lint yield (tons) ha ⁻¹
Planting date 7 th May, 2013 – 2014	18.16a	14.15a	52.11a	4.05a
7 th June, 2013 - 2014	14.22b	12.27ab	45.91b	2.18b
7 th July, 2013 - 2014	10.50c	12.27b	34.78c	2.89b
7 th August, 2013- 2014	7.88d	10.68b	23.92d	2.83b
LSD	2.55	2.49	2.70	1.10
Period of weed control (WAS)				
0	10.11c	7.05d	33.04d	2.77c
3	16.14a	12.35a	48.13a	4.60a
6	15.26ab	10.24b	45.64b	3.14b
9	14.38b	8.69c	35.50c	2.92c
LSD	1.12	1.02	3.04	0.93
Interaction PD x PWC		NS	NS	NS