

Effect of Weeding Regimes on Spring Onion (*Allium fistulosum* L.) and Weed Infestation in the Humid Tropical Rainforest Agro - Ecological Zone of Nigeria

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Abstract

Weed infestation constitutes a major constraint in the production of Spring Onion, especially in an organic Cropping system where the use of synthetic herbicides is not allowed. This study was carried out within the wet season of 2024 at the teaching and research farm of the Department of Agricultural Education, Federal College of Education (Technical) Akoka, Lagos (6.50444° N and 3.338333° E) in the Humid Tropical rainforest Agro- ecological zone of Nigeria to determine the influence of weeding regimes on performance of organic Onion as well as weed growth. The treatments consist of four weeding regimes; weeding at 2 and 4 weeks after transplanting, at 4 and 6 WAT, 2 and 6 WAT and a weedy check. The treatments were laid out in a randomized complete block design (RCBD) with three replicates. Data collected on plant height, number of leaves per plant, weed dry matter production and crop yield were subjected to the analysis of variance (ANOVA) while separation of means with significant difference was done through the LSD at 5% level of probability. Results showed that weeding at 2 and 6 WAT significantly ($P < 0.5$) increased plant height, number of leaves per plant, depressed weed dry matter production and significantly increased yield (1947kg/ha) compared to other treatments. The minimum yield (160kg/ha) was obtained in the weedy checks. In all, when compared to the maximum of the treatment involving weeding at 2 and 6 WAT, there was a yield loss of 91.78% due to uncontrolled weeds. Thus, the first early weeding and second weeding at the appropriate interval is necessary for optimum performance of Spring Onion.

Key words: Spring Onion, Weeding, Growth, Yield

Introduction

Spring Onion (*Allium fistulosum*) is a perennial crop and a native of Eastern Asia. It is a good source of vitamins A and K, iron, calcium, and dietary fiber, which helps to boost human general health such as improving blood pressure and cholesterol levels (Paulino, et al, 2024). This crop belongs to the family Amaryllidaceae. It is utilized in different forms such as soup ingredients, salads and. It gives flavor and pleasant scent similar to that of garlic (Kim et a., 2023). Spring onion can also be eaten raw, cooked, depending on various cultural backgrounds. The peculiar characteristic narrow, elongated bulbs with less pungent flavor makes it more ideal for raw consumption unlike the normal bulb – forming onion.

The chromium nutrient element content in spring onion has been found to be useful in macronutrient metabolism and in glucose regulation. Previous researches have also shown that spring onions are high in vitamin C, which enhances healthy skins and immune systems. It is also a good source of vitamin K and useful minerals such as iron and Calcium, apart from dietary fiber it provides (Paulino et al., 2024).

Spring onion has a wide spread cultivation across the world but the area of highest cultivation is East Asia, specifically areas like China, Taiwan, Japan, Phillipines, Malaysia and Indonesia. In Africa, the areas with the leading production are; Ghana, Sudan, Kenya, Cameroon, Congo and a few other countries. Morocco produces more than any other African countries and are currently the major exporters of Spring onion to the European markets (Kayat et al.,2021; Kim et al.,2023).

Among many constraints limiting the productivities of onions generally, including spring onion, is weed competition (Pushpa and Choudhary, 2019). This crop has some peculiar growth patterns such as slow germination, very slow growth and susceptibility to different flush of weeds. Besides, spring onion has shallow root system, narrow leaves, non branching stem, with poor canopy formation (Awoke, et al., 2020). Yield reduction of up to 40 – 80% has been recorded in onion production due to weed infestation (Das, 2013; Grief, 2015).

In large scale onion production, weeds have been controlled mostly with the use of chemical methods. However, as a result of the global awareness that chemical usage in agricultural production have adverse effect on human and environmental health, there is now a growing demand for organic food produce. However, many farmers who have adopted manual weeding are still ignorant of the appropriate timing of weeding or weeding regime suitable for optimum growth and yield in spring onion production.

Therefore, the objectives of this study was to determine the influence of different weeding regimes on performance of Organic Spring onion as well as the impact of the various weeding regimes on weed growth.

Materials and Methods

Field experiment was conducted within the wet season of 2024, at the teaching and research farm of the Department of Agricultural Education, Federal College of Education (Technical) Akoka, Lagos (6.50444⁰ N and 3.338333⁰E) in the Humid Tropical Agroecological zone of Nigeria. The average Temperature and rainfall is 24 -27⁰ C and 1,500 – 2,000mm, respectively, per annum. The soil type is basically loamy Sand. Details of the soil analysis at the experimental site is represented in Table 1.

Prior to the commencement of the trial, weed flora on the site were noted viz; Broad leave which include; *Tridax procumbens* Linn. of moderate infestation, *Commelina benghalensis* L. of low infestation and *Pupalia lappacea* (Linn.) Juss. of low infestation. The grass Specie

was *Paspalum conjugatum* (Berg.) of low infestation while the Sedge Specie was *Schoenoplectus senegalensis* (Hochst. ex Steud.).

The experimental treatments consist of four weeding regimes viz; weeding at two and four weeks after transplanting; four and six weeks after transplanting; two and six weeks after transplanting and a weedy check. The treatments were laid out in a randomized complete block (RCBD) design with three replicates.

Land preparation was done with the use of hoe and cutlass for clearing while bed construction was done with hoe. Field lay out was made according to treatment while poultry manure was applied at the rate of 10 tons per hectare, a week before transplanting . Plot size was 1m by 1m with 20cm by 25cm plant spacing to obtain 200,000 spring onion plants per hectare.

The underground stems of spring onion, variety Welsh was obtained from a local farmer at Alapere, Lagos. Transplanting was done at one plant per stand with the spacing of 20 by 25cm on 5th June, 2024 according to treatment.

Data was collected on plant height, number of leaves per plant, weed dry matter production and crop yield which was done by taking the weight of all the uprooted spring onion plants within the net plot. All data collected were subjected to the Analysis of Variance (ANOVA) with the use of Minitab, fashion 18, while mean separation was done through the Least Significant Difference (LSD) at 5% level of probability.

Table 1. **Soil Analysis for the Experimental Site**

Soil Composition	% level Composition
<u>Particle size analysis</u>	
Sand %	78.8
Clay %	4.7
Silt %	16.5
Textural Class	Loamy Sand
<u>Chemical Composition</u>	
pH	6.85
N %	0.199
Org. C %	0.897
Org. M %	1.546
Av. P mg/kg	19.86
Ex. A mEq/100g	0.4
Na cmol/kg	0.342
K cmol/kg	0.536
Ca cmol/kg	0.315
Mg cmol/kg	9.374

Results and Discussion

Effect of weeding Regimes on Plant height of Spring onion

Table 2: Effect of weeding regimes on Plant height of spring onion

Treatments	3 WAT	5 WAT	7 WAT
Weeding at 2nd and 4th Week after trans-planting	25.95a	28.39ab	34.27ab
Weeding at 4th and 6th Week after trans-planting	24.16a	27.74ab	34.01ab
Weeding at 2nd and 6th Week after trans-planting	25.41a	31.63a	37.36a
Weeding Checks	20.54a	26.41b	31.65b
LSD 0.5			

There is significant difference ($P < 0.5$) in plant heights of Spring onions due to treatment (Table 2). At 3 weeks after transplanting, plant heights were similar, indicating that the early growth stage of spring onion is less affected by the timing of weeding. This could be attributed to the minimal competition for soil nutrients and other resources at this stage, allowing the plants to perform uniformly across treatments. However, at 5 and 7 WAT, the treatments with weeding at 2 and 6 WAT maintained the highest plant height (31.63 and 37.36cm, respectively, which was also comparable to those of weeding at 2 and 4 WAT as well as 4 and 6 WAT while the weedy check had significantly shorter plant height throughout the life cycle of spring onion. This implies that weeding both early and later during the critical period of plant growth effectively reduced crop – weed competition for nutrients and other growth factors, enabling the plants to achieve optimal growth. This result is in agreement with the reports of Awoke et al. (2020) that weeding at the appropriate time considerably suppressed weed growth and enhanced proper growth of Spring onions which include plant height. Similarly, research has shown that weeds significantly limited onion growth and hence the need for weeding at the appropriate time (Akande and Oladimeji, 2015).

Effect of Weeding Regimes on the number of Leaves of Spring onion

Table 3. Effect of weeding regimes on number of leaves of spring onion

Treatments	3 WAT	5 WAT	7 WAT
Weeding at 2nd and 4th Week after trans-planting	4.92b	10.77b	13.83ab
Weeding at 4th and 6th Week after trans-planting	6.77ab	8.68b	13.75ab
Weeding at 2nd and 6th Week after trans-planting	7.33a	15.02a	18.25a
Weeding Checks	4.75b	7.27b	7.00b
LSD 0.5			

There was a significant difference in the number of leaves throughout the growth period of spring onion (Table 3). The maximum number of leaves (7.33, 15.02 and 18.25) at 3, 5 and 7 WAT, respectively, was obtained in the treatment involving weeding at 2 and 6 WAT at all stages of crop growth, followed by those of weeding at 2 and 4, as well as the treatment with weeding at 4 and 6 WAT. The minimum number of leaves (4.75, 7.25 and 7.00 at 3, 5 and 7 WAT, respectively, were obtained at the plots left weedy. This indicates that early weed removal in combination with follow-up weeding at an appropriate time might have enhanced more leaf development by minimizing competition for critical resources like nutrients, water,

and light during the early stages of growth. Conversely, unchecked weed growth might have allowed for greater competition between crop and weeds, resulting in reduced leaf numbers during this period. Onions are generally susceptible to weed infestation largely because of their slow growth and narrow leaves with poor canopy formation which make weeds to have a competitive advantage over the crop (Pushpa and Choudhary, 2019; Awoke et al., 2020). In this study, the timely weeding at 2WAT and a supplementary follow up weeding at 6WAT probably enhanced proper development of leaves.

From previous research, Das (2013) emphasized the importance of the critical weed-free period, during which crops must be free of weeds to maximize their growth potential. This principle is supported by the results of this study, as the 2nd and 6th week weeding regime effectively aligned with the critical growth stages of spring onions.

Effect of Weeding Regimes on the Weed dry matter

Table 4. Effect of weeding Regimes on weed dry matter (kg/ha)

Treatments	3 WAT	5 WAT	7 WAT
Weeding at 2nd and 4th Week after trans-planting	644b	521b	88.90c
Weeding at 4th and 6th Week after trans-planting	5600a	5498a	66.67c
Weeding at 2nd and 6th Week after trans-planting	511b	449b	400b
Weeding Checks	4578a	4440a	1067a
LSD 0.5			

The effect of weeding regime on weed dry matter is presented in Table 4. Weeding regime significantly ($P < 0.5$) affected weed dry matter production. Except towards the end of the life cycle of spring onion, significantly lower (511kg/ha and 449kg/ha) weed dry matter were obtained for weeding regime involving weeding at 2 and 6 WAT especially at the early stages of growth of crop. Although this was comparable to that of the treatment involving weeding at 2 and 4 WAT. However, the treatment involving weeding at 4 and 6WAT had weed dry matter similar to that of the weedy check. Weed dry matter production indicates the effectiveness of any weed management strategy because it is a serious reflection of weed growth dynamics on crop field. In this results, weeding the plots at the critical period of crop – weed competition resulted in lower weed dry matter production while a delay in weeding led to a significantly higher weed dry matter. This result is similar to that reported by Awoke et al. (2020)

Effect of Weeding Regimes on Spring onion Yield

Table 5. Effect of weeding regimes on spring onion yield

Treatments	Yield (kg/ha)
Weeding at 2nd and 4th Week after trans-planting	1207ab
Weeding at 4th and 6th Week after trans-planting	913.3bc
Weeding at 2nd and 6th Week after trans-planting	1947a
Weeding Checks	160c
LSD 0.5	

The yields of spring onion as influenced by weeding regime is shown in Table 5. There is significant difference in spring onion yield due to treatments. The yields obtained in the treatments involving weeding at 4 and 6 WAT (913.3kg/ha) was significantly lower and comparable to the minimum (160kg/ha) obtained in the weedy check while the yield in the regime involving weeding at 2 and 4 WAT (1207kg/ha) was comparable to the maximum (1,947kg /ha) obtained in treatment involving weeding at 2 and 6 WAT.

The higher yields obtained in the treatment involving weeding at 2WAT and 6WAT could be due to the fact that the weeding regime was timely and facilitated proper utilization of soil nutrients and other growth resources to the advantage of the crop, compared to other treatments.

The lower crop yield obtained in the treatment involving weeding at 4 and 6 WAT could be attributed to delayed first weeding at the critical period of crop – weed competition. Similarly, the relatively lower yield in treatment involving weeding at 2 and 4 WAT could be due to the fact that the regime did not have season - long effect on later emerging weeds which eventually led to reduced yield.

In this study, the total yield loss due to unchecked weed growth is 91.78%

These results corroborate the findings of previous researchers who reported that yield reduction of up to 40 – 80% has been recorded in onion production due to weed infestation (Das, 2013; Grief, 2015).

In similar researches, Dhananivetha et al. (2017) as well as Pushpa and Choudhary (2019) reported that weeding onion plots at the appropriate frequency and timing significantly reduced weed growth dynamics and ultimately enhanced onion yield.

Conclusions

From this study, Weeding regimes had a significant effect on the growth, yield of spring onion and weed growth. The treatments involving weeding at the 2nd and 6th weeks after transplanting consistently produced taller plants, higher number of leaves at all growth stages (3 WAT, 5 WAT, and 7 WAT). This same weeding regime also significantly suppressed weed dry matter production, especially during the early growth period of onion crop. This study concludes that early weeding at about two weeks after transplanting and a follow up supplementary weeding at about six weeks after transplanting might be adequate for optimum growth and yield of spring onion around the agroecological zone of the experiment.

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