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This official scientific publication of the Faculty of Agriculture, Abdullahi Fodiyo University of Science and Technology Aliero, is a non-profit, open access, double-blind peer-reviewed Journal publishing four issues (January, April, July and October) per annum. The Journal is a platform open to collaborations with researchers, authors, institutions, research agencies and private companies related to Agriculture. The Mission of the Journal is to disseminate scientific knowledge through the publication of original research articles, research notes, book reviews, letters to the editor and reviews of Literature, representing a contribution to scientific and technological knowledge in respective areas covered by the Journal. The Kebbi Journal of Agriculture and Natural Sciences seeks to validate and disseminate new knowledge, making it public in order to strengthen the human capacity, constitute a link in the scientific community to the society and encouraging the expansion of University and academic researches.

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The first page of the manuscript should contain the title of the article, which should be concise and explicit, typed with upper-case, bold, 14 font size, TNR and not more than 21 words. The surname and forenames (in full) of authors, affiliation of each author should be provided. Phone number and email address of the corresponding author (identified by an asterisk) should be provided. Superscripts should be used to relate authors to their affiliations.

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Results should be presented concisely. Only in exceptional cases will it be permissible to present the same set of results in both Table and figure. In discussion, point out the significance of the results and place the results in the context of other work and theoretical background. Results and Discussion part could be written separately if author so wish.

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DeVries, J. and Toenniessen, G. (2001). *Securing the Han/est Biotechnology, Breeding and Seed Systems for African Crops*. The Cromwell Press, Trowbridge, Wiltshire, UK. 208pp.

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ECONOMICS OF WEED MANAGEMENT PRACTICES USED AMONG ONION FARMERS IN ALIERO LOCAL GOVERNMENT AREA, KEBBI STATE, NIGERIA.

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ABSTRACT

The economics of several weed control strategies on onion fields in Aliero local government, Kebbi state, Nigeria, were investigated. The study relied on original data gathered from 120 farmers. The villages that were questioned were chosen at random using a stratified random sampling approach. Onion producers were found to primarily adopt two key weed management practices: cultural (hoe or hand weeding) and pesticide usage. The average weed cost of family labour utilizing cultural practices was ₦50,000.0, hired labour cost ₦185,000.0, herbicide spray cost ₦2,500.0/liter, liters of herbicide cost ₦5500.0/liters, and herbicide purchase cost per hectare was ₦22,000.0. The study reveals that onion farmers in Aliero Local Government Area, Kebbi State, Nigeria, primarily use chemical and manual weed control methods, with hired labor being the most expensive at an average cost of ₦185,000.0 per hectare. It was suggested that the government provide various and more herbicides to farmers at subsidized rates, which would increase their production and eliminate drudgery. To minimize direct contact with their crops and plant harm, onion farmers should be instructed on how to administer herbicides. Many farmers were found to be uninformed about pesticide spraying and its impacts on health.

Keywords: economics, weed control strategies, onion fields, herbicides, farmers

Introduction

Onion, herbaceous biennial plant (*Allium cepa*) of the Allliaceae family, is presumably native to southern Asia but now farmed across the world, with its edible bulb. Onions are one of the most hardy and oldest garden vegetable plants, with a cluster of tiny, greenish white blooms on one or more leafless stalks. The subterranean mature edible onion forms as the leaf bases expand. Onions are unpleasant; peeling or slicing them can induce tears because they contain a sulfur-rich volatile oil. The size, shape, color, and pungency of onions varies. Despite being deficient in conventional nutrients, they are praised for their flavor (Pareek *et al.*, 2017). Onions have been claimed to heal colds, earaches, and laryngitis, as well as to treat animal bites, powder burns, and warts; they, like its close relative garlic, are being examined for additional potentially therapeutic properties. Since ancient times, onions have been recognized as both a food and a medicinal plant. It is the most commonly farmed vegetable bulb crop, second only to tomato,

and is known to most civilizations and consumed globally (FAO, 2012). It is a low-latitude, short-growing horticultural crop. It is referred to as the "Queen of the Kitchen" because of its highly prized flavor, scent, and distinct taste, as well as the therapeutic benefits of its favour components (Griffiths *et al*., 2002). Throughout the year, onions are used in curries, as spices, in salads, as a condiment, or cooked with other vegetables, such as boiled or baked. It is also utilized in many kinds of processed food, such as pickles, powder, paste, and flakes, and it has therapeutic properties (Pareek *et al.,* 2017). Onion soil should be deep, friable, and rich. Onions, on the other hand, may be grown in any soil type. Sandy soil requires more frequent watering and promotes early development, but heavy soils produce malformed bulbs that cause problems when digging bulbs. Cool soils are suitable for high yield and quality bulbs. Generally, sandy loam to clay loam soil is preferred. Between 5.8 and 6.5 is the ideal pH range. Onion farming is not possible on soils that are extremely alkaline or saline. Most of its cultivars' vegetative development is inhibited by salt concentrations more than 4 mmhos/cm2. It is critical to have good drainage. Crop failure can occur as a result of waterlogging. Onions are quite vulnerable to the impacts of a rising water table (Kumar, 2012).

The onion crop is more susceptible to weed infestation and is often plagued by a diverse range of broad leaf and grassy weeds. Weeds compete with the crop for water, soil nutrients, light, and space, reducing onion crop bulb production significantly. One of the limiting factors in excellent onion bulb output is weed infestation. It is more susceptible to weed competition than most other vegetable crops, owing to its slow initial growth and inherent onion characteristics such as short stature, non-branching habit, sparse foliage, shallow root systems, and frequent irrigation and fertilizer application, which results in severe crop-weed competition. Weeds impede with bulb growth and raise farming costs. Weed competition lowered onion bulb output by 2.35-61.8 percent depending on crop weed competition length and severity (Sankar *et al.,* 2015). Weed removal by hand is time-consuming, expensive, and labor-intensive. This condition necessitates the use of herbicides for efficient and timely weed control in this crop. Proper and timely weed management strategies are critical for onion bulb development. It is thus critical to plan a proper approach of weed control through the application of various herbicides in order to increase profitability for the country's onion producers (Kumar, 2014). In general, weed infection reduces onion crop output by 30 to 60%; certain weeds are parasites, either partially or completely, on crop plants. Weeds degrade the quality and quantity of plant and animal products; for example, prickly weeds harbor insects, pests, and illnesses. Weeds raise labour and equipment costs, and they diminish the carrying capacity of grazing fields and pasture. Weed control is crucial because of the direct affects weeds have on yield and production costs, as well as the direct effects they may have on onion production; weeds reduce yields by competing for sunshine, nutrients, and water (Vijayvergiya et al., 2018). Considering the damage caused by weeds in onion fields, as one of the most commonly used vegetables in dishes all over the world, a study was conducted to determine the various weed management methods and their costs in onion production in Aliero local government of Kebbi state, Nigeria.

Materials and Methods

Study Area

The study was conducted in Aliero Local Government Area of Kebbi State. Aliero lies between latitude 12° 16'42'N and 4°27'6'E of the equator. It has total land area of 412 square

kilometer with an estimated population of about one hundred and twenty-five thousand, seven hundred and eighty three people (125,783) (NPC, 2006). It is boarded in North-East by Gwandu local government area, in the south-East by Jega local government area, and in the North-West by Birnin Kebbi local government area.

The annual temperature varies considerably but usually ranges between 26^0C-38^0C, while mean annual rainfall is about 500mm. The major crops cultivated in the study area include, Guinea corn, millet, groundnut, maize, onion, tomatoes and pepper. Aliero community is one of the major producers of Onion in Nigeria and has one of the largest markets in North-West Nigeria (Kaka et al., 2022).

Sampling Procedure and Sampling Techniques

Onion is generally cultivated in almost all parts of Aliero local government area, purposively Stratified random sampling was use in arriving at sample size. The Local Government Area consists of three (3) district areas that is Aliero, Sabiyal and Dan-warai districts. Therefore; data were collected from 120 farmers selected at random from 6 villages of three districts which was selected from the local government area to arrive at a sample size of one hundred and twenty (120) farmers.

Data Collection

The primary data were collected with the use of questionnaires and interview schedule, while the secondary data, were collected from journals, textbooks, and other relevant materials.

Analytical Tool

Descriptive statistics such as frequency distribution, percentages and cost analysis were used to determine the objective of the study.

Result and Discussion

Table 1 below shows the type of weed management practiced by farmers in the study area. It reveals that 31.7% respondents practice cultural method of weed management and these is because, Cultural weed practice is not widely use because is the oldest of method weed control and consist of pulling and slashing of weeds by hand and hoe which require a lot of stress and affects the health condition of the body causing chronic back pain, and prevent children from going to school. The advantages is seen by the users because weeded plant is incorporated into the soil thereby adding nutrient to the soil content and some of which serves as feed to livestock animals. The disadvantages causes low rate of its adoption by farmers (Chikoye *et al*., 2007). 68.3% of respondents uses chemical method in managing their weed, herbicides as an alternative to hand weeding. Herbicides can be sprayed before planting to remove weeds from a field or farm, applied directly to soil at planting for residual control of germinating weed seeds, the use of herbicides is widely accepted by onion farmers because it makes their work to be more easier and faster in its process, and it also, enable children to attend school without being delayed doing farm work. This is in according to findings of (Chikoye *et al*., 2007) who believed farmers are switching from the cultural weed management practices to chemical weed management practice. Also it agrees with (Mashingaidze, 2001; Chikoye *et al.*, 2004; Chikoye et al., 2010; Sinha & Lagoke, 1983). In another development some researchers believed combining the two in an onion field will increase the yield. This include (Khokhar et al., 2016; Vigyan & Deoghar, 2022).

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Table 1: Distribution of Farmers Based on Weed Management Practice

Management practices	**Frequency**	**Percentage (%)**
Cultural (hoe/hand)	38	31.7
Chemical	82	68.3
Total	120	100

Sources: Field Survey, 2023

Table 2 presented below meticulously delineates the financial expenditures associated with the implementation of chemical weed management practices within the specified study area, thereby offering a comprehensive overview of the economic implications of such agricultural interventions. In particular, the application of chemical herbicides per hectare of cultivated onion land in the designated study region amounted to an expenditure of precisely twenty-two thousand two hundred naira only (₦22,000), while the associated costs related to the spraying processes were recorded at two thousand five hundred naira (₦2,500). Consequently, when aggregating these costs, the total financial outlay incurred reached a sum of twenty-four thousand five hundred naira only (₦24,500), thereby underscoring the significant investments required for effective weed management in this context. This comprehensive financial assessment aligns with the previously reported findings in the literature, as noted by Matthews (2018), alongside the contributions of Senseman (2007) and Ashton & Monaco (1991), thereby reinforcing the validity of the observed cost structure. Such concordance with established studies not only enhances the credibility of the current research but also provides valuable insights into the economic dimensions of chemical weed management practices within the agricultural sector.

Table 2: Cost Incurred for Chemical Weed Management Practice

Average costs/ha	Amount (₦)
Chemical (herbicide) 4litres/ha	22000
Spraying cost	2500
Total	24500

Source: Field Survey, 2023

Table 3 delineates the various financial expenditures associated with cultural weed management practices that were observed within the designated study area, which serves as a critical point of analysis for agricultural economics. It becomes evident from the data that hired labor represents the most substantial financial burden, with a cumulative expenditure amounting to 185,000 Naira, thereby highlighting the significant economic implications of employing external labor forces. In contrast, family labor, which is often conceptualized as the opportunity cost of labor, emerges as a more advantageous alternative when farmers have access to familial resources to undertake agricultural tasks on their plots. When the total average expenses of all labor types are aggregated, it results in an impressive figure of 235,000 Naira per hectare dedicated to onion cultivation, a substantial cost that reflects the intensive labor demands of this particular crop. The availability of family labor is noteworthy, as it is typically abundant and can be mobilized with relative ease during critical production periods, a phenomenon that has been extensively documented in agricultural studies (Singh, 2017). A considerable portion of this familial labor is characterized by being either unpaid or compensated at a lower rate, which effectively contributes to a reduction in overall labor costs associated with farm operations (Ellis, 1993). Moreover, family members exhibit a unique flexibility that allows them to respond adeptly

to the fluctuating demands and evolving priorities of the agricultural enterprise (Moll, 2015). Additionally, the intrinsic motivation that family members possess to aid in the success and prosperity of the farm cannot be overstated, as it plays a pivotal role in enhancing productivity and fostering a sense of communal responsibility (Bryant, 2016). The familial environment also facilitates a reciprocal exchange of skills and knowledge among members, which can ultimately lead to significant improvements in the management practices employed on the farm (Singh, 2017). Nonetheless, it is imperative to acknowledge that family laborers may, at times, forfeit alternative income-generating opportunities in order to fulfill their duties on the farm, which can have broader economic implications (Ellis, 1993). Furthermore, the extended hours that family members dedicate to agricultural activities can result in physical fatigue and a subsequent decline in overall productivity levels, which is an important consideration in labor management (Moll, 2015). In this context, the necessity for family members to seek training and acquire new skills becomes apparent, as it is essential for them to remain competitive and well-informed in modern agricultural practices (Bryant, 2016). It is also critical to bear in mind that the health and safety of family laborers may be compromised while they are engaged in various farming activities, exposing them to potential risks that must be managed effectively (Singh, 2017). The economic dynamics associated with family labor are further underscored by the fact that such labor is frequently either unpaid or compensated at minimal rates, which substantially lessens the financial burden of labor costs for the agricultural enterprise (Ellis, 1993). Family members possess the remarkable ability to adapt and recalibrate according to the shifting demands and priorities inherent in the farming process, showcasing their invaluable contribution to agricultural sustainability (Moll, 2015). The motivation that drives family members to participate actively in the farm's endeavors is often rooted in a deep-seated commitment to its success and viability, which significantly enhances overall productivity (Bryant, 2016). Moreover, the informal educational environment that exists among family members allows for the continuous acquisition of new skills and knowledge, thereby facilitating improved management practices and operational efficiency on the farm (Singh, 2017). It is noteworthy that family laborers may, at times, relinquish other potential income sources to dedicate time and effort to the farm, which presents an intriguing intersection of labor economics and family dynamics (Ellis, 1993). Additionally, the long hours that family members may work in the agricultural sector can lead to an onset of fatigue, which could adversely impact their effectiveness and productivity levels (Moll, 2015). Lastly, the need for family members to pursue training and development opportunities to enhance their skill sets further illustrates the ongoing evolution of labor requirements within the agricultural landscape (Bryant, 2016). Lastly, the potential health and safety risks that family laborers encounter while engaged in farm work must be the engagement of hired labor can significantly contribute specialized skills and expertise to agricultural operations, which ultimately leads to a marked increase in both efficiency and productivity, as evidenced by the research conducted by Kumar in the year 2017. Furthermore, the utilization of hired labor enables a remarkable degree of scalability; it can be adjusted either upwards or downwards in accordance with the specific and ever-changing needs of the farm, thereby providing a level of flexibility and adaptability that is essential in modern agricultural practices, as noted by Singh in 2019. It is also important to mention that the employment of hired labor can mitigate

various risks that are typically associated with labor, which include but are not limited to injuries, illnesses, and disputes arising from labor relations, as highlighted in the analysis by Mishra in 2018. Moreover, hired labor provides invaluable access to specialized skills and expertise that encompass a range of critical functions, such as the operation of machinery, the management of irrigation systems, and the effective control of pests, which are all vital components of successful agricultural management, as articulated in Kumar's research from 2017. The presence of specialized labor can not only streamline operations but also result in heightened output and yields, as this expertise enables the optimization of crop management practices, a phenomenon thoroughly discussed in Singh's findings from 2019. However, it is crucial to acknowledge that the financial implications of hiring labor can be substantial, with hourly wages varying considerably, typically falling within a range of ₦7751 to ₦31,000, contingent upon factors such as geographical location and the skill level of the workers, as noted in Mishra's 2018 study. In addition to wages, employers may be required to extend benefits and make social security contributions for their hired labor, which adds an additional layer of expense that must be factored into the overall budget for labor, as indicated in Kumar's analysis from 2017. It is also noteworthy that the process of effectively training and developing hired labor can incur further costs, which must be taken into account when assessing the financial viability of such labor practices, as pointed out by Singh in 2019. Moreover, the management of hired labor can necessitate the allocation of additional resources and financial expenditure, which may include the implementation of specialized labor management software as well as the hiring of personnel dedicated to labor oversight, as outlined in Mishra's 2018 examination of labor management, addressed proactively to ensure a sustainable and safe working environment (Singh, 2017).

Table 3: Cost Incurred for Cultural Weed Management Practice

Average costs/ha	Amount (₦)
Hired Labor	185,000
Family Labor	50,000
Total	235,000

Source: Field Survey, 2023

Conclusion:

Weed management is a critical aspect of onion production, and farmers in Aliero Local Government Area, Kebbi State, Nigeria, employ various practices to control weeds. This study examined the economics of weed management practices used among onion farmers in the area. The results showed that the majority of farmers used chemical weed control methods, followed by cultural and manual methods. The average cost of weed management per hectare was estimated to be ₦24,000, with hired labour weed control being the most expensive method. Consequently, the results derived from this study may function as an invaluable and pivotal reference point for subsequent scholarly investigations that are focused on enhancing and refining weed management strategies, as well as evaluating and minimizing their associated financial implications specifically within the realm of onion cultivation and analogous agricultural scenarios that share similar characteristics and challenges.

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