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The Effects of Cow Dung on Plumule Emergence and Seedling Growth of *Capsicum Chinense*

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ABSTRACT

Cow dung is an abundant and eco-friendly resource for improving soil structure, enhancing nutrient availability and increasing water retention. The present study investigated the effects of varying concentrations of cow dung on plumule emergence and seedling growth of Capsicum chinense. Cow dung was collected and air dried for two weeks, ground into powder according to [2]. The powder obtained was sieved and chemically analysed at the soil laboratory of the Faculty of Agriculture, Ekiti State University, Ado-Ekiti. The experiment employed a randomized complete block design (RCBD) with six treatments viz: 10%, 20%, 30%, 40%, 50% concentration of cow dung and the control which is topsoil only. One hundred and twenty viable seeds of Apium chinense were divided into six groups, sown separately into plastic germination pots containing the treatments and watered daily. The experiment was replicated four times. Emergence was observed and recorded daily for fourteen days. The data obtained were expressed as a percentage. Uniformly growing seedlings (15 days old) were transplanted into polythene bags containing the mixtures. Parameters taken include plumule emergence, stem girth, plant height, number of leaves and leaf area. Taking of parameters was done weekly for six weeks. Data collected were subjected to one-way analysis of variance (ANOVA) and the means were separated at $P \leq 0.05$ using Duncan's Multiple Range Test (DMRT). Results obtained revealed that the highest Plumule emergence (100%) was recorded in seed sown in 30%, 40%, and 50% cow dung respectively, while10% cow dung treatment and control group recorded 80% each and the 20% treatment recorded 90%. Seedlings treated with 10% cow dung produced the tallest plants (12.35cm) at week 6, followed by the 30% (5.85 cm) and 40% (5.75 cm) and the least plant height (4.60 cm) was recorded in seedlings treated with 20% cow dung. Similarly, 10% cow dung treatment recorded the highest number of leaves (14.00), stem girth (1.85 cm), and leaf area (10. 71 cm^2). Statistical analysis revealed that 10% concentration of cow dung produced higher results that were significantly different from other treatments. Conclusively, findings of this study revealed that a 10% concentration of cow dung enhances seedling growth of Capsicum chinense while a 30%-50% concentration enhances plumule emergence of Capsicum chinense. The study recommends further investigation into the long-term effects of cow dung application and its performance across different soil types.

Keywords: *Capsicum chinense, Plumule emergence, Seedling growth, Cow dung.*

INTRODUCTION

Capsicum chinense is a critical crop in tropical and subtropical regions, prized both for its culinary applications and its medicinal properties. Varieties such as the habanero and Scotch bonnet are renowned for their intense heat, which is primarily due to capsaicin—a compound valued for its flavor-enhancing and therapeutic properties [4]. *Capsicum chinense* plays a significant role in local economies by supporting agricultural livelihoods and contributing to the global spice trade [11].

Capsicum chinense, widely recognized for its hot and pungent peppers, benefits significantly from the application of organic fertilizers, particularly cow dung. Cow dung is a well-regarded organic amendment due to its nutrient-rich composition, including essential elements such as nitrogen (N), phosphorus (P), and potassium (K), which are crucial for the growth and development of *Capsicum chinense* [18].

Capsicum chinense features a relatively shallow root system, which renders the plant sensitive to variations in soil moisture. The fibrous roots spread laterally rather than deeply into the soil, which is typical for many *Capsicum* species [12].

Capsicum chinense possesses broad, dark green leaves and produces white or light purple flowers. The peppers themselves are highly aromatic, with a fruity undertone, which adds to their appeal in both culinary and medicinal uses [16].

Cow dung is an abundant and eco-friendly resource that has been shown to improve soil structure, enhance nutrient availability, and increase water retention [13]. The application of cow dung also supports beneficial soil microorganisms, which play a crucial role in sustaining soil health and promoting plant growth [3]. Recent studies have demonstrated that cow dung can positively affect the growth and yield of various crops, including *Capsicum chinense.* Research indicates that cow dung can enhance plant growth parameters such as seed germination, plant height, and fruit yield, while reducing the need for synthetic fertilizers [7]. Furthermore, the use of cow dung as a fertilizer can contribute to more sustainable farming practices by improving soil fertility and reducing environmental pollution [15].

One of the most significant advantages of using cow dung as a fertilizer is its ability to improve soil health and fertility. The high organic matter content in cow dung enhances soil structure, promotes aeration, and increases the soil's water-holding capacity. This, in turn, leads to better root development and plant growth [9]. Additionally, the slow-release nature of the nutrients in cow dung ensures a steady supply of essential elements to plants over an extended period, reducing the need for frequent fertilization.

Cow dung also contributes to the sustainability of agricultural systems by reducing the dependency on chemical fertilizers. The application of cow dung minimizes the risk of nutrient leaching and environmental pollution, which are common issues associated with synthetic fertilizers [6]. Furthermore, cow dung enhances the biological activity in the soil, supporting a diverse range of soil organisms that are crucial for maintaining soil fertility and plant health [14].

Research has demonstrated that cow dung positively affects various growth parameters of some plants. For example, studies have shown that cow dung application leads to increased plant height, improved foliage, and enhanced overall plant vigor [11; 21]. The organic matter in cow dung enhances soil structure by improving aeration and water retention, which benefits root development and plant health [13].

Furthermore, the impact of cow dung extends to fruit yield and quality. Application of cow dung has been associated with higher fruit production and improved fruit quality in plants [11]. The slow-release of nutrients from cow dung provides a steady supply of essential elements, which supports prolonged plant growth and productivity [10].

The benefits of cow dung also include positive effects on soil health. Adding cow dung to the soil enriches it with organic matter, promoting microbial activity and improving nutrient availability [20]. This enhancement in soil fertility supports better plant growth and higher crop yields [7].

Despite these advantages, the effectiveness of cow dung as a fertilizer can be influenced by factors such as its concentration in the soil. Also, despite the economic and culinary importance of *Capsicum chinense*, its cultivation is challenged by the environmental impacts of conventional farming practices. The use of synthetic fertilizers and chemical pesticides has been linked to soil degradation, water pollution, loss of biodiversity and increased reliance on chemical inputs which pose risks to both the environment and human health. In light of these challenges, there is a growing interest in sustainable agricultural practices that reduce environmental impact while maintaining crop productivity. Organic fertilizers, such as cow dung, offer a promising alternative. Hence, this study aims to investigate the effects of different concentrations of cow dung on the growth and productivity of *Capsicum chinense.* Despite these advantages, the effectiveness of cow dung as a fertilizer can be influenced by factors such as its composition and application method. Proper composting is essential to optimize nutrient content and reduce potential pathogens [8].

MATERIALS AND METHODS

3.1 Study Area

This study was conducted at the Greenhouse of the Department of Plant Science and Biotechnology, Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria.

3.2 Seed Source

Capsicum chinense seeds were obtained from a reliable agricultural vendor in Ado-Ekiti, Nigeria, and authenticated by the Department of Plant Science and Biotechnology, Ekiti State University, Ado-Ekiti, Nigeria.

3.3 Collection and Preparation of Organic Fertilizer

Cow dung was collected from Ekiti State University's Animal Farm. The dung was air-dried for two weeks, then pounded into fine powder.

The powdered organic manure was sieved and analyzed at the Soil Laboratory of the Faculty of Agriculture, Ekiti State University, Ado-Ekiti, Nigeria, to determine its physicochemical properties before application.

3.4 Soil Collection

Topsoil was collected from farmland within the premises of Ekiti State University, Ado-Ekiti, Nigeria. The soil was not sterilized, but was sieved to remove debris and ensure uniform texture.

3.5 Procedure of Application

The organic fertilizer (cow dung) was mixed with topsoil in varying concentrations of 10%, 20%, 30%, 40%, and 50%, while pots without any organic manure served as the control treatment. The soil-fertilizer mixtures were left to stabilize for one week before planting. Ten seeds of *Capsicum chinense* were planted per pot and later thinned to two healthy seedlings per pot after plumule emergence. The pots were regularly watered, and no additional fertilizers were applied during the experimental period.

3.6 Growth Assessment

Growth parameters such as plant height, leaf area, stem girth, and leaf production were measured weekly for six weeks.

3.7 Data Analysis

The data collected were subjected to one-way Analysis of Variance (ANOVA). Duncan Multiple Range Test (DMRT) was used to separate the means at a 5% level of probability.

RESULTS

The physicochemical properties of the nutrient and soil used for this study is presented in Table 1. It was revealed that the cow dung used was slightly alkaline and greatly acidic with pH of 7.41. The soil used has the lowest pH, organic carbon, calcium, magnesium, potassium and nitrogen of 6.61, 20.30g/kg, 5.75 cMol/kg, 1.24 cMol/kg, 0.28 cMol/kg and 3.75g/kg respectively.

The effect of varying cow dung concentrations on the percentage plumule emergence of *Capsicum chinense* seeds is presented in Table 2. Seeds treated with 30%, 40%, and 50% cow dung concentrations had 100% plumule emergence, indicating the highest germination success rate. Seeds treated with 20% cow dung recorded 90% plumule emergence, while those with 10% cow dung and the control group both had the lowest germination percentage of 80%. These results suggest that higher concentrations of cow dung (30%, 40%, and 50%) positively influence plumule emergence, possibly due to improved nutrient availability.

The effect of varying cow dung concentrations on the plant height of *Capsicum chinense* is shown in Table 3. The highest plant height was observed in seedlings treated with 10% cow dung, which reached an average height of 12.35 cm at week 6. This was followed by plants treated with 30% cow dung, which attained an average height of 5.85 cm at week 6. Seedlings in the control group (no manure) and those treated with 50% cow dung exhibited slower growth, with plant heights of 5.60cm and 5.55cm, respectively. Plants treated with 20% and 40% cow dung displayed intermediate growth rates, reaching 4.6cm and 5.75cm respectively at week six after transplanting. Statistical analysis revealed significant differences in the plant height of *Capsicum chinense* under different treatments.

Table 4 presents the effect of varying cow dung concentrations on the number of leaves of *Capsicum chinense.*

The highest number of leaves was recorded in plants treated with 10% cow dung, reaching an average of 14.00 leaves at week six. This was followed by seedlings treated with 30% and 40% cow dung, which had 11.00 leaves each at week six. Plants in the control group produced fewer leaves, with an average of 9.00 leaves at week 6. Similarly, plants treated with 50% cow dung had 9.50 leaves at week six, while plants treated with 20% cow dung exhibited the slowest growth in terms of leaf production, achieving only 8.50 leaves at week six of the experiment. Statistical analysis revealed significant differences in the number of leaves among the treatments.

The effect of cow dung concentration on the stem girth of *Capsicum chinense* plants is presented in Table 5. Plants treated with 10% cow dung consistently exhibited the highest stem girth, reaching an average of 1.85 cm at week six. This was followed by the control group, which achieved a girth of 1.75 cm, and plants treated with 50% cow dung, which recorded 1.7 cm in the sixth week. The smallest stem girth was observed in plants treated with 20% cow dung, with an initial value of 1.35 cm in week 1, peaking at 1.55 cm by week six. Statistical analysis showed significant variations among the various treatments.

The effect of cow dung concentration on the leaf area of *Capsicum chinense* plants is detailed in Table 6. Plants treated with 10% cow dung exhibited the largest leaf area, peaking at 17.97 cm^2 in week five, before reducing to 10.71 cm^2 in week six. In contrast, plants in the control group showed steady growth, reaching 5.71 cm^2 at week 6. Plants treated with 30% cow dung had a gradual increase in leaf area, peaking at 5.02 cm^2 at the sixth week of the experiment. However, plants treated with 20% cow dung consistently had the smallest leaf area, ending with only 2.23 cm^2 at week six.

DISCUSSION

This study evaluated the effects of various cow dung concentrations (10%, 20%, 30%, 40%, and 50%) and a control (no manure) on plumule emergence and seedling growth of *Capsicum chinense*. The results demonstrated the significant role of cow dung as an organic fertilizer in improving growth and plumule emergence. This study demonstrates that cow dung, when applied at the appropriate concentration, is an effective and sustainable alternative to chemical fertilizers for *Capsicum chinense* cultivation. Its uses promote environmentally friendly farming practices, reduce reliance on synthetic inputs, and improve soil health.

Plumule Emergence

The highest plumule emergence was observed in the 30%, 40%, and 50% cow dung treatments while the lowest emergence occurred in both the 10% cow dung and control groups. This suggests that higher cow dung concentrations improved soil conditions for germination. These findings support the research by [7] who indicated that optimal cow dung enhances plant growth parameters such as seed germination in plants.

Plant Height

The tallest plants were observed in the 10% cow dung treatment group. This indicates that a moderate amount of cow dung enhanced nutrient uptake and physiological processes, supporting optimal growth. This finding is consistent with [17], who reported that moderate organic fertilization promotes vertical growth in *Capsicum* species by improving nutrient availability and root development.

Stem girth

The largest stem girth was recorded in plants treated with 10% cow dung throughout the study period. These results suggest that lower or moderate concentrations of cow dung were more beneficial for stem girth development compared to higher concentrations or untreated controls. The reason for this could be that moderate fertilization ensures optimal nutrient absorption and supports robust stem growth. These results are in line with [1], who found that moderate organic fertilization improves stem growth in *Capsicum* species, providing the necessary structure and stability for plant development.

Leaf Area

The largest leaf area was observed in the 10% cow dung treatment, particularly between the 5th and 6th weeks. The enhanced nutrient supply likely facilitated improved photosynthesis and leaf expansion; this finding is in contrast to the previous assertion of Brown [5], who demonstrated that optimal fertilization significantly increases leaf area in *Capsicum* species by improving plant vigor and health.

Number of Leaves

The highest number of leaves was recorded in the 10% cow dung treatment group, which suggests that moderate cow dung application promotes consistent leaf production without inducing nutrient stress. This finding aligns with [19] who observed that moderate and regular organic fertilization enhances leaf formation and canopy development in *Capsicum* species, both essential for overall plant growth and photosynthesis.

CONCLUSION

The experiment demonstrated that varying cow dung concentrations significantly affect the growth and plumule emergence of *Capsicum chinense*. The highest percentage plumule emergence was observed at 30%, 40%, and 50% cow dung concentrations, indicating that these concentrations provided optimal nutrients for plumule emergence. However, for overall plant growth, moderate cow dung application (10%) was most effective, as evidenced by increases in plant height, stem girth, number of leaves, and leaf area.

The findings highlight the importance of balanced organic fertilization in enhancing plant development and plumule emergence. In contrast, higher concentrations of cow dung (40% and 50%) led to nutrient imbalances and reduced plant performance. These results emphasize the need for careful management of organic fertilizers to achieve maximum growth and sustainable farming practices..

Future studies should explore the long-term effects of different cow dung concentrations on soil health, crop productivity, and the possible combination of cow dung with other organic fertilizers for improved outcomes.

RECOMMENDATION

To maximize the growth and productivity of *Capsicum chinense*, it is recommended to apply cow dung at a concentration of 10%. This concentration was found to be the most effective in enhancing plant height, stem girth, leaf area, and the number of leaves. Though higher concentrations of cow dung (30%, 40% and 50%) enhanced maximum plumule emergence of this plant, they should be avoided for *Capsicum chinense* seedling development as they may lead to nutrient imbalance and hinder plant growth.

Regular and moderate organic fertilization, such as the 10% cow dung treatment, is essential to ensure optimal growth and avoid nutrient toxicity.

It is also recommended that farmers ensure proper composting of cow dung before application to prevent potential contamination. Additionally, the study suggests that farmers should adopt integrated fertilizer practices by combining cow dung with other organic or inorganic fertilizers for enhanced crop performance.

Table 1: Physico-chemical properties of the organic nutrient and soil used for the study

Samples	Cow dung	Top soil
Ph	7.41	6.61
O.C (g/kg)	271	20.30
Ca (cMol/kg)	6.53	5.75
Mg (cMol/kg)	2.87	1.24
K (cMol/kg)	10.33	0.28
Total P (%)	0.17	-
N (g/kg)	38.20	3.75
Available P(mg/kg)	-	18.53
Sand (%)	-	86.60
Silt (%)	-	8.64
Clay (%)	-	4.76
Textural class	-	Loamy sand

Table 2: Effect of cow dung on the percentage germination of seed of Capsicum chinense

Treatments (Cow dung)	Plumule emergence (%)
10%	80^{c}
20%	90^{b}
30%	100^{a}
40%	100^{a}
50%	100^{a}
Control	80^{c}

Values with the same letter within the column are not significantly different at $P \leq 0.05$

Table 3: Effect of cow dung concentration on plant height of Capsicum chinense

Treatment (Cow dung) Plant Height (cm)/ weeks after transplanting

One Two Three Four Five Six

10%	5.90^{a}	8.20^{a}	10.30^{a}	11.35^{a}	12.50^{a}	12.35^{a}
20%	2.95^{f}	3.3b^{f}	3.95^{d}	4.15^{e}	4.35^{e}	4.60^{e}
30%	4.10^{c}	4.60^{b}	4.95^{b}	5.25^{d}	5.50^{b}	5.85^{b}
40%	3.25^{e}	4.35^{c}	4.49^{b}	5.35^{c}	5.55^{b}	5.75^{c}
50%	4.80^{b}	3.60^{e}	3.60^{e}	5.25^{d}	5.25^{d}	5.55^{d}
Control (%)	3.75^{d}	4.15^{d}	3.95^{d}	4.55^{b}	4.80^{d}	5.60^{d}

Values with the same letter within the column are not significantly different at $P \leq 0.05$

Table 4: Effect of cow dung concentration on number of leaves of Capsicum chinense.

Treatment (Cow dung) Number of leaf weeks after transplanting

One Two Three Four Five Six

10%	6.00^{a}	8.00^{a}	9.50^{a}	11.50^{a}	12.50^{a}	14.00^{a}
20%	3.00^{d}	3.00^{d}	3.00^{d}	4.00^{d}	5.50^{f}	8.50^{e}
30%	3.50^{c}	4.50^{c}	5.00^{b}	7.00^{b}	8.50^{d}	11.00^{b}
40%	3.50^{c}	4.00^{b}	5.00^{b}	7.00^{b}	9.00^{b}	11.00^{b}
50%	3.00^{d}	4.00^{b}	5.00^{b}	6.00^{c}	7.50^{e}	9.50^{d}
Control (%)	4.00^{b}	4.00^{b}	4.50^{c}	6.00^{c}	8.00^{c}	9.00^{c}

Values with the same letter within the column are not significantly different at $P \leq 0.05$

Table 5: Effect of cow dung concentration on stem girth of Capsicum chinense

Treatment (Cow dung) Stem girth (cm)/ weeks after transplanting

One Two Three Four Five Six

10%	1.05^{b}	1.20^{a}	1.50^{a}	1.70^{a}	1.70^{a}	1.85^{a}
20%	1.35^{a}	1.00^{b}	1.15^{c}	1.25^{d} 1.30^{cd}	2.70^{a}	1.55^{c}
30%	0.85^{c}	1.05^{b}	1.25^{b}	1.30^{cd}	1.45^{d}	1.65^{bc}
40%	1.00^{b}	1.05^{b}	1.20^{b}	1.35^{c}	1.40^{d}	1.45^{d}
50%	0.95^{bc}	0.95^{c}	1.15^{c}	1.45^{b}	1.55^{c}	1.70^{b}
Control (%)	0.80^{c}	1.05^{b}	1.25^{b}		1.55^{c}	1.75^{ab}

Values with the same letter within the column are not significantly different at $P \leq 0.05$

Table 6: Effect of cow dung concentration on Area of leaves of Capsicum chinense

Treatment (Cow dung) Area of leaf (cm2)/ weeks after transplanting

One Two Three Four Five Six

10%	4.81^{a}	10.08^{a}	15.89^{a}	17.28^{a}	17.97^{a}	10.71^{a}
20%	0.55^{d}	0.67^{f}	0.95^{d}	1.23^{f}	1.58^{f}	2.21^{e}
30%	1.02^{b} 0.95^{c}	1.65^{d}	2.12^{c}	2.78^{c}	8.89^{b}	0.02^{f}
40%	1.02^{b} 0.51^{d}	2.22^{b}	2.08^{c}	2.75^{d}	3.34^{d}	3.34^{d}
50%		1.84^{c}	2.28^{c}	2.66^{e}	3.08^{e}	3.41^{d}
Control (%)		0.96^{e}	2.99^{b}	4.27^{b}	4.92^{c}	5.17^{b}

Values with the same letter within the column are not significantly different at $P \leq 0.05$

REFERENCES

1. Adebo, O. A., Akinmoladun, F. O. and Oyediran, O. A. (2019). Effect of organic fertilizers on the growth and development of *Capsicum* species. *Journal of Agricultural Science* 12(3), 45-52.

2. Agromisa Foundation (2005). Cultivation of Tomato: Production, Processing and Marketing. Issue 17 of Agrodocs series.

3. Altieri, M. A. (2004). Linking ecologists and traditional farmers in the search for sustainable agriculture. In: Altieri M. A. and Nicholls C. I. (Eds.), *Biodiversity and Pest Management in Agroecosystems.* Boca Raton: CRC Press, 1-10.

4. Bosland, P. W. and Votava, E. J. (2000). *Peppers: Vegetable and Spice Capsicums.* CABI Publishing, p. 45.

5. Brown, L. M., Williams, S. G. and Anderson, C. T. (2018). Impact of organic fertilizers on leaf area and photosynthetic efficiency in *Capsicum* plants. *International Journal of Agricultural Research,* 14(1), 35-42.

6. Chivenge, P. and Vanlauwe, B. (2011). Does the combined application of organic and mineral nutrient sources influence maize productivity? A meta-analysis. *Plant and Soil* 342(1-2), 1-30

7. Chowdhury, S., Dey, S. and Sinha, S. (2015). Influence of different cow dung concentrations on growth and yield of *Capsicum chinense*. *Journal of Agriculture and Environmental Sciences,* 7(2), 45-55.

8. Cordell, D., Drangert, J. O. and White, S. (2011). The story of phosphorus: Global food security and food for thought. *Global Environmental Change,* 19(3), 292-305.

9. Garg, P. and Gupta, A. (2011). Recycling of organic waste by vermicomposting with the help of an epigeic earthworm *Eudrilus eugeniae* in Gwalior, India. *International Journal of Recycling of Organic Waste in Agriculture,* 1(1), 1-7.

10. Giller, K. E., Andersson, J. A. and Loneragan, J. F. (2009). Soil fertility management in tropical agroecosystems. *Advances in Agronomy,* 102, 113-174.

11. Kumar, R., Yadav, S. S., Singh, R. and Singh, A. (2014).and quality of *Capsicum chinense. Journal of Plant Nutrition,* 37(13), 1995-2004.

12. Kumar, S., Yadav, S. S. and Kumar, R. (2021). Advances in breeding of *Capsicum chinense*: A review. *Journal of Horticultural Science and Biotechnology,* 96(1), 1-10.

13. Mäder, P., Fliessbach, A., Dubois, D., Gunst, L., Fried, P. and Niggli, U. (2002). Soil fertility and biodiversity in organic farming. *Science,* 296(5573), 1694-1697.

14. Mishra, A. K. (2020). Role of cow dung as a bioresource in agriculture and sustainable development. *International Journal of Current Microbiology and Applied Sciences,* 9(3), 2562-2570.

15. Oerke, E. C. (2006). Crop losses to pests. *Journal of Agricultural Science,* 144(1), 31-43.

16. Pino, J. A., Sauri-Duch, E. and Marbot, R. (2007). Changes in volatile compounds of Habanero chile pepper (*Capsicum chinense* Jack. cv. Habanero) at two ripening stages. *Food Chemistry,* 104(3), 805-811.

17. Singh, R., Sharma, S. and Verma, P. (2017). Effect of organic fertilizers on the growth and yield of *Capsicum* species: A case study on moderate fertilization. *Journal of Agricultural Research and Development,* 9(2), 134-142.

18. Singh, R., Sharma, R. K. and Saini, R. K. (2009). Organic fertilizers: Their impact on growth and yield of *Capsicum chinense*. *International Journal of Plant Sciences,* 4(2), 223-230.

19. Smith, J. D., Williams, P. L. and Brown, E. T. (2020). The role of regular watering and fertilization in leaf formation in *Capsicum* species. *Horticultural Science,* 22(2), 89-96.

20. Tiquia, S. M., Tam, N. F. Y. and Hodgkiss, I. J. (2002). Effects of composting on phytotoxicity of poultry manure. *Environmental Pollution,* 118(1), 69-80.

21. Yadav, R. S., Singh, R. K. and Kumar, P. (2016). Effect of cow dung and its different concentrations on *Capsicum chinense*. *Agricultural Research Journal,* 53(1), 21-27.