IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 14, Issue 1 Ser. I (January 2021), PP 14-20
www.iosrjournals.org

Shoot Growth and Yield of Transplanted Senna obtusifolia (Sickle pod) Seedlings in Response to Different Levels (0g, 4g, 8g and 12g) of NPK (15:15:15) Fertilizer in Bichi: A Potential Crop for Post COVID-I9 Economic Recovery

Abdulazeez Abubakar
Department of Agricultural Education, Federal College of Education (Technical) Bichi, Kano, Nigeria.

Abstract: *To avoid low fertilization, over fertilization or wastage and determine the optimum level of complete and essential fertilizer needed for better production of Senna obtusifolia crop, the application of levels of NPK 15:15:15 fertilizer on the shoot growth and yield of Senna obtusifolia was investigated. The trial was conducted at training and research farm of Department of Agricultural Education, Federal College of Education (Technical) Bichi in 2019 and 2020 raining seasons. The objectives were to investigate nursery seed sowing, shoot growth and yield of transplanted Senna obtusifolia seedlings in response to different levels (0g/plant, 4g/plant, 8g/plant and 12g/plant or 0kg/ha, 320kg/ha, 640kg/ha and 960kg/ha respectively) of NPK (15:15:15) fertilizer. The trial was randomized complete block design, with four treatments and three replications to give total of twelve trial plots including control in which there was no NPK fertilizer application. All data collected were subjected to Analysis of Variance (ANOVA) using GENSTAT package while separation of significant means was done using Least Significance Difference (LSD) at 5% probability level. Data collected included plant height, number of pods per plant, number of seeds per plant, total seed yield per hectare, canopy length, days to maturity and dry matter weight per plant. The application of NPK 15:15:15 at 640kg/ha or 8g/plant was significantly different from others in shoot growth and yield parameters. Higher mean marketable total seed value (196kg/ha) was observed with treatment 640kg/ha or 8g/plant of NPK fertilizer application, it also performed better in number of pods and dry weight matter. The application of 640kg/ha or 8g/plant of NPK 15,15,15 fertilizer is appropriate in attaining high seeds and dry matter in Senna obstusifolia for post COVID-19 economic recovery.*

Key words: *NPK fertilizer, Senna obtusifolia, transplanting, growth, yield, employment, COVID-19*

Date of Submission: 26-12-2020 Date of Acceptance: 07-01-2021

I. Introduction

Plants require food (certain chemical elements) for growth and development. Among macronutrients, plants utilize greater quantities of nitrogen, phosphorous and potassium (NPK) from the soil and these needs to be replaced in greater quantities (Gopal, 1990). Hence they are regarded as major, macro or essential plants/crops nutrients and the other are micronutrients. The quantity of nutrients required by crops varies depending on crop characteristics, environmental conditions, soil characteristics and soil-crop management (John et al 2012). Nitrogen, adequate nitrogen maintains a large dark green colour of crop leaves, prolific tillering, shoot density and tolerance to pest stress. It impacts fast growth, promotes vegetative growth, improves the quantity of fodder, seeds and fruits. Nitrogen deficiency or over fertilization enhances susceptibility to diseases, lodging, reduced root and shoot growth, reduced flowering and fruit setting and crop yield (John 2012 and Sasakawa 2018). Phosphorous, phosphorous stimulates early seedling vigour, early strong root development, shoot growth and blooming, fruit setting and seed formation. In legumes it induces nodule formation and thus N-fixation. With poor supply or over fertilization of phosphorous, the growth of shoots and roots is restricted, weak seedlings, thin stems, branches and foliage restricted with pigmentation, flowering and fruiting may be delayed (Gopal, 1990, John 2012 and Sasakawa 2018). Potassium, potassium increases water supply to plant growing points, improves quality of seeds and fruits, encourages shoots and roots growth and plant stand density. Poor or over fertilization of potassium makes plant susceptible to diseases, weak plants, poor growth and poor quality seeds and fruits (Gopal, 1990, John 2012 and Sasakawa 2018).

COVID-19. A novel strain of coronavirus - SARS-CoV-2 – COVID-19 - was first detected in December 2019 in Wuhan, a city in China's Hubei province with a population of 11 million, after an outbreak of pneumonia without an obvious cause. The virus has now spread to over 200 countries and territories across the globe, and was characterized as a pandemic by the World Health Organization (WHO) on 11 March 2020 (Julia, 2020). As of 5 October 2020, there were 35,027,546 laboratory-confirmed cases of coronavirus disease 2019

(COVID-19) infection globally, with 1,034,837 reported deaths. The number of cases and deaths outside of China overtook those within the country on 16 March 2020 (WHO 2020). The coronavirus disease 2019 (COVID-19) is profoundly affecting life around the globe. Isolation, contact restrictions and economic shutdown impose a complete change to the psychosocial environment in affected countries. These measures have the potential to threaten the mental health of children and adolescents significantly. One major challenge after the pandemic will be to deal with its sequelae. One main consequence will be the economic recession and its implications for mental health of children and their families, individuals and nations. Economic problems may be recognized mainly after the acute phase of the pandemic, although their starting point was in an earlier phase. Some parents (people) might have lost their jobs or businesses, while others might have to deal with an accumulated workload or face major re-organization at work (Feger et al, 2020). COVID19 has led to unprecedented disruption, affecting all markets and economies globally. Things will not be the same again, people need to think out of the box (matthew 2020).

Senna obtusifolia. Senna obtusifolia also known as sicklepod (L) Irwin and Barney, can be found in tropical South America, tropics and subtropics regions of all continents. Senna obtusifolia belongs to the kingdom plantae and family fabaceae (Irwin and Barney, 1982). The World and Nigeria in particular is seriously facing a growing demand for food, income and employment. To address this issue, it is urgent to give sincere attention to research, conscious and extensive cultivation, industrial processing, value addition, local and international marketing of Senna obtusifolia crop and its products. Abdulazeez (2018) observed that, Senna obtusifolia is not a notorious weed, rather is an economic crop which has wide range of local and international uses in foods, medicines, textiles, income, low, medium and large scale industries and employment. The young tender leaves of Senna obtusifolia are used as vegetable and food throughout Africa (fig, 1) Ken, 2020,). Roasted seeds of Senna obtusifolia have been used as substitute for coffee. Senna obtusifolia seeds gums are good alternative for locust bean and guar gums (Burkill, 1995). Senna obtusifolia seeds gums are used in a range of applications, including foods, medicine, textile and paper manufacturing in India, Australia and Korea (Daily Trust, 2018, David and Kerry, 2001). The seeds, the macerated leaves and the roots provide black, blue, yellow and orange dyes (Ken, 2020). Ismaila (2011), reported that Senna obtusifolia leaves contained 5.2% crude protein, 2.6% crude fibre, mineral elements such as calcium, sodium and some anti nutritional factors. In Africa, senna obtusifila stems are used for thatched fence and firewood (Ken, 2020). The shade dried Senna obtusifolia leaves are suitable for livestock feed (figs. 2 and 3). Senna obtusifolia grows extensively in Northern Nigeria; it is a potential crop that can earn Nigeria over #11billion ($30million) annually from cultivation of the crop (Abdulazeez, 2018). Subsistence, commercial cultivation and industrial processing of Senna obtusifolia can increase the income of an individual and the nation, and equally ameliorate the global post COVID-19 economic crisis (figs, 4-6). Senna obtusifolia grows naturally and widely, however, it is difficult to obtain uniform germination, emergence and growth when sown directly on the field. Therefore, the trial on senna obtusifolia nursery seeds sowing and transplanting are required for documentation. The objectives of the trial are: i, to raise Senna obtusifolia crop from nursery seed boxes to maturity on the field and ii, to investigate the shoot growth and yield of transplanted Senna obtusifolia crop in response to different levels of NPK fertilizer and iii, to determine optimum level of NPK (15:15:15) fertilizer application for Senna obtusifolia crop.

Fig.1. Post COVID-19 Economic recovery; Senna obtusifolia balanced food for all. Ingredients - senna obtusifolia leaves, maize grains (2mm), ground nut cake (2mm), palm oil and salt. The plant leaves harvested 40 days after transplanting.

Fig. 2. Post COVID-19 Economic recovery: Animal meat for all. Senna obtusifolia shade dried leaves, suitable feed for small and large ruminant animals.

Fig.3. Post COVID-19 Economic recovery: Employment/income for all. Shade dried Senna obtusifolia leaves in bags: A sustainable feed for large and small ruminant.

Fig. 4. Post COVID-19 Economic recovery, Employment/income for all. Senna obtusifolia seeds collection, nursery sowing, field preparation, seedlings transplanting, weeding, fertilization, pest/diseases control, cutting, harvesting storage, processing and marketing of Senna obtusifolia.

Fig. 5. Post COVID-19 Economic recovery. Employment/income for all, Industrial processing, value addition and bagging of Senna obtusifolia dried seeds.

Fig. 6. Post COVID-19 Economic recovery, Employment/income for all. Bags of Senna obtusifolia seeds for use in food, pharmaceutical, medicine, paper and textile industries, field and laboratory investigations.

II. Materials and Method

2.1 Trial Area

The trials were conducted during the 2019 and 2020 rainy seasons at the training and research farm of Department of Agricultural Education, Federal College of Education (Technical) Bichi, Kano State, Nigeria. Federal College of Education (Technical) Bichi is located on latitude 8^0 14^I-12^0 14^IE and longitude12^0 14^I-14^0 13^IN in the Sudan Savannah zone of Nigeria. The soil type was a sandy clay loam with pH 7.4 and organic matter 0.6%. The trial area was prepared using combination of tractor mounted disk harrow and traditional hoe.

2.2. Senna obtusifolia nursery seed boxes/plastic materials

The Senna obtusifolia nursery seeds boxes were two plastic materials of 28cm in diameter and 15cm deep with drainage holes at the bottoms (fig. 7). The two plastics materials were filled with sandy loam soil and watered. Four hundred Senna obtusifolia seeds obtained from the Department of Agricultural Education training and research farm were treated in ordinary water for 24 hours and, carefully sown/placed over the wet sandy loam soil in the plastic containers and covered with sand (Abdulazeez, 2016). Each nursery seed box/plastic material was sown to 200 Senna obtusifolia seeds. The two nursery seed boxes were kept in green house of Department of Agricultural Education for proper management.

Fig.7. Post COVID-19 Economic recovery, Employment/income for all. Treatment of seeds, preparation and management of Senna obtusifolia seedlings in nursery boxes/plastic materials.

2.3. Pulling and Uprooting of Senna obtusifolia seedlings

Fourteen days after emergence of Senna obtusifolia seedlings from the two nursery seed boxes/plastic materials, 10cm tall and have developed their second pair of leaves. The two nursery seed boxes/plastic materials were watered, seedlings gently pulled and uprooted with soil individually and transplanted to the field.

2.4. Transplanting of Senna obtusifolia seedlings to trial plots on the field

The main trial field was a six year (2013-2018) fallow land. The common plants freely growing on the fallow land are; Andropogon gayanus, Amaranthus spinosus, Cynodon dactylon, Commelina erecta, Euphorbia hirta, Digitaria horizontalis and Senna obtusifolia (Sicklepod). The field was prepared using combination of tractor mounted disk harrow and traditional hoe. The size of the main field was 48m x 36m, this was divided into sub plots of three replicates, each measuring 4m x 3m. The four treatments were 0g, 4g, 8g and 12 g of NPK (15:15:15) fertilizer. The healthy, uniform in growth and vigour Senna obtusifolia seedlings were transplanted to each trial plot at 11cm deep, firmly covered with soil and at 50cm x 50cm x 50cm spacing

(Abdulazeez, 2018). The treatment applications were randomized completely. The treatment was applied three weeks after transplanting (WAT) and the second was applied at four weeks after the first application. The treatment was applied by side dressing, at 5cm from base of each stand of Senna obtusifolia transplanted seedling. Weeding commenced at two weeks after transplanting and the second weeding at six weeks after the first weeding. Four Senna obtusifolia plants were randomly selected at the centre of each replicate and tagged for measurements, data collection and determination of shoot growth and yield parameters. The vegetative parameter assessed included plant height, canopy length, days to maturity and dry matter weight and yield parameters were number of pods per plant, number of seeds per plant and total seeds yield per hectare (fig. 8).

Fig. 8. Post COVID-19 Economic recovery, Employment/income for all. Management of Shoot growth and yield of transplanted Senna obtusfolia seedlings in response to different levels of N.P.K. (15:15:15) fertilizer in the trial field

III. Results and Discussion

Data Analysis. Data for the two years were pooled for the shoot growth and yield as presented in table 1.

Table 1. Shoot Growth and Yield of Transplanted Senna obtusifolia (Sickle pod) Seedlings in Response to Different Levels (0g, 4g, 8g and 12g) of NPK (15:15:15) Fertilizer in Bichi: A Potential Crop for Post COVID-I9 Economic Recovery

Levels of NPK (15:15:15) fertilizer application (g)				
Plant parameters	0	4	8	12
Plant height/plant (cm)	135^{d}	177^{b}	192^{a}	162^{c}
Number of pod/plant	106^{d}	224^{b}	312^{a}	176^{c}
Number of seeds/plant	1802^{d}	4032^{b}	6552^{a}	3168^{c}
Total seeds yield/ha	54^{d}	120^{b}	196^{a}	95^{c}
Canopy length (cm)	114^{d}	127^{b}	131^{a}	121^{c}
Days to maturity	152^{c}	147^{b}	143^{a}	150^{c}
Dry matter weight/plant (g)	173^{d}	271.4^{b}	409.2^{a}	262.8^{c}

Different letters within a row indicate significant difference ($p<0.05$).

Height of plant (cm). The plant height was measured with the help of a meter measuring flexible tape . The measurement was taken at harvest. Data regarding the plant height revealed highly significant results for NPK (15:15:15) fertilizer treatments. Mean values indicated that 8g/plant had significant superiority over other means. 8g/plant was at the top position (192cm) followed by 4g/plant (177cm) and 12g/plant was at the bottom (162cm). This situation indicated that by increasing NPK fertilizer application to Senna obtusifolia crop, height of the plant was increased to a point and then declined (table 1). The results corroborate the findings of John et al, (2012) and Sasakawa (2018) who reported that over fertilization of plant reduced root and shoot growth.

Number of pod per plant. The response of number of pod/plant of Senna obtusifolia to different level of NPK (15:15:15) fertilizer is presented in table 1. The results indicated that there were consistent increases in number of pod/plant from 224 to 312, after which there was a decline in the number of pods/plant to 176. There were significant differences ($P<0.05$) across the treatments. The plant that received 8g level of NPK fertilizer had the highest number (312) of pod/plant, followed by 4g (224) and lowest number (176) of pod/plant was recorded for plants with 12g level of fertilizer application. John et al (2012), reported that optimum nitrogen fertilizer application improves quality fodder, pod, seeds and fruiting and over fertilization reduced flowering, seeds, fodder and pods.

Number of seeds/plant. Favourable number of seeds yield/plant was achieved in trial assigned with 8g level of NPK fertilizer. The highest number of seeds/plant (6552) was recorded in treatment with 8g level of NPK

fertilizer, followed by 4g (4032) and 12g level of fertilizer application recorded the least (3168) number of seeds per plant (Table 1).

Total seeds yield per hectare. The total seeds yield per hectare were counted, weighed and recorded after the harvest. Results suggested significant superiority of treatment 8g/plant over all other treatments. Treatment 8g was superior (196kg/ha) to 4g (120kg/ha) and 12g (54kg/ha). It was noted from the results that with increased of fertilizer applications the total marketable total seeds yield per hectare increased accordingly and later decline due to over fertilization (Table 1). Similar findings were also observed by John et al (2012).

Canopy length (cm). In the results in table 1, the treatment with 8g of NPK fertilizer application occupied the highest position significantly. The results showed that there were gradual increases in canopy length of Senna obtusifolia across treatments with increase in fertilizer application. The data showed that plant treated with 8g level of NPK fertilizer had the longest canopy length (131cm) followed by 4g (127cm) and 12g treatment had the shortest value (121cm).

Days to maturity. Observations showed that Senna obtusifolia in plots with 8g level of NPK (15:15:15) fertilizer performed better than others in days to maturity. Treatment 8g level of fertilizer had the shortest days (143) to maturity, while the treatment 4g had 147 days followed by 12g with longest days (150) to maturity (table 1). This is in line with the works of John et al (2012) and Sasakawa (2018) who reported similar results that with over fertilization of phosphorous, the growth of shoots and roots is restricted, maturity – flowering and fruiting may be delayed.

Dry matter weight (g/plant). Significant differences in dry matter weight per plant were observed among the treatments in table 1. The highest (409.2g) and lowest (262.2g) dry matter weights per plant were related to the 8g and 12g levels of NPK fertilizer applications respectively, while 4g treatment had intermediate dry matter weight (271.4g). The considerable and significant superiority in dry matter weight of 8g level of fertilizer application over others may be due to the optimum NPK fertilizer applied to the plant.

IV. Conclusion/Recommendation

Senna obtusifolia (sicklepod) seeds can be treated in ordinary water, sown in plastic materials/nursery boxes, grow in to healthy seedlings which are able to endure the shock of uprooting, transplanting, heavy traffic and have potential to grow very well in shoot and yield on the field.

The arbitrary use of NPK (15:15:15) fertilizer not only incurs financial losses, but also unproductive and harmful to the Senna obtusifolia crop. This trial recommends optimum 8g per plant or 640kg of NPK (15:15:15) fertilizer per hectare, split application at three weeks after transplanting and at four weeks after the first application for Senna obtusifolia crop. Senna obtusifolia mechanical cultivation and industrial processing can completely put an end to Nigeria youths unrests (#ENDSARS 102020 protests, cults, kidnappings, bandits, etc). The Local, State and Federal Governments of Nigeria, the Food and Agricultural Organization (FAO) and World Health Organization (WHO) should consider Senna obtusifolia crop value chain for post COVID-19 economic recovery programme.

Acknowledgements

This research study was carried out with assistance of good people. My first vote of thanks goes to Mrs, Asiata O. Abdulazeez and Mal. Isiyaku Umar Bichi for presentation of balanced Senna obtusifolia food. I sincerely thank Mr. Olubo Felix and Senna obtusifolia (Tafasa) Traders Association of Nigeria at Dawanau International Food Market, Kano for the pictures used in this research, Mal. Ado, Mal. Umar Adamu, Mal. Mustapha Bich and Mal. Muazu Bichi for effective management of the Senna obtusifolia trial crops on the field. Laboratory technologists of plant science at Ahmadu Bello University Zaria, for carrying out proximate analyses on the trial soil. Finally, my children; Muminat Abdulazeez and Kauthar Abdulazeez for typing the manuscript. I am thankful and may the Merciful Lord bless you all. Amen.

References

[1]. Gopal C.D (1990). Fundamental of Agronomy. Institute of Agriculture. West Bengal. Oxford and IBH Publishing Co-PVT. Ltd. New Delhi. India.

[2]. John L.H, James, D.B, Samuel, LT, and Werner, LN (2012). Soil fertility and fertilizer. An introduction to Nutrients Management. 7th edition. PHI Learning private limited. New Delhi.

[3]. Sasakawa Africa Association (2018). Fertilizer and Fertilizer Calculation. A paper presented at Department of Agricultural Education, Federal College of Education (Tech) Bichi, Kano, Nigeria. 2018.

[4]. Julia R (2020). Everything you should know about the coronavirus outbreak. *The Pharmaceutical Journal* 5 OCT 2020.

[5]. World Health Organization. (2020). https://www.who.int/ith/2020-24-01-outbreak-of-Pneumonia-caused-by-new-coronavirus/en/ (accessed January 2020)

[6]. Fegert, J.M., Vitiello, B., Plener, P.L. *et al*. (2020). Challenges and burden of the Coronavirus 2019 (COVID-19) pandemic for child and adolescent mental health: a narrative review to highlight clinical and research needs in the acute phase and the long return to normality. *Child Adolesc Psychiatry Ment Health* **14,** 20 (2020). https://doi.org/10.1186/s13034-020-00329

[7]. Matthew E.L, (2020*).* **COVID-19 Challenges in Developing Countries.** *Adjunct Professor of Medicine, Drexel University College of Medicine*

[8]. Irwin, H.S and Barneby R.C (1982). The American Cassiinae. Memoirs of the New York Botanical Garden. 25: 1-918.
[9]. Abdulazeez, A (2018). Effect of three intra-row spacing (50cm, 25cm and 10cm) on growth, yield and biological characteristics of Senna obtusifolia: A plant for economic diversification in tropical zone. IOSR, Agriculture and Veterinary Science. Volume 11, issue 1, version-1.pp 38-45.
[10]. Ken F (2020). Tropical plants Database.ken,fem.tropical.theferns.info. 2020-08-31.
[11]. Burkill, H.M (1995). The useful plants of West Tropical Africa. 2nd edition. Vol. 3. Families J.L. Royal Botanical Gardens, Kew Richmaond, United Kingdom. 857pp.
[12]. Daily Trust, (2018). Senna obtusifolia (Tafasa) can boost Nigeria economy. Nigeria Daily Trust News paper, Lagos. May 7th 2018.
[13]. David, C and Kerry W (2001). Rural Industries Research and Development Corporation. Senna tora gum production in Australia.
[14]. Ismaila, Y, Denban, M, Emmanuel, I.C and Augustine, C (2011). Nutritional and Phytochemical screening of Senna obtusifolia indigenous to Mubi, Gongola State, Nigeria. Advances in Applied Science. Reas. 2(3). 4432-4437. USA
[15]. Abdulazeez, A (2016). Effect of hot water on breaking seed dormancy of Senna obtusifolia in Bichi, Nigeria, in green house conditions. IOSR, Agriculture and Veterinary Science. Volume 9, issue 10, version-1.pp 29-32.

Abdulazeez Abubakar. "Shoot Growth and Yield of Transplanted Senna obtusifolia (Sickle pod) Seedlings in Response to Different Levels (0g, 4g, 8g and 12g) of NPK (15:15:15) Fertilizer in Bichi: A Potential Crop for Post COVID-I9 Economic Recovery." *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, 14(1), 2021, pp. 14-20.