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Soil and Agronomic Management for Cucumber Production in Nigeria

Bernard Ndubuisi Okafor and Japhet J. Yaduma

Abstract

Cucumber (*Cucumis sativus*. L) is an important crop; widely cultivated in different agroecologies of Nigeria. Its production continues to gain attention in Nigerian communities because of their nutritional and economic values. Average yield per/ha is below world average. Factors responsible for the low yield include inappropriate farming systems, climate change, pests and diseases infestation, poor access to credit facilities, inappropriate method of cultivation, distance to market and low availability of land. Important but often neglected is the quality/fertility status of cucumber producing soils of Nigeria. Fertiliser use is inadequate and application is often based on blanket recommendation. Low soil quality and poor agronomic management have contributed to >40% decrease in yield. With good agricultural practices and soil management, optimum yield can be attained.

Keywords: cucumber, soil, agronomy, Nigeria

1. Introduction

Demand for vitamins and minerals are highly dependent on vegetables. Cucumber and other fruit and leafy vegetables are in high demand because of their nutritional and economic values. According to [1], cucumber production has the capacity to enhance agricultural production, economic empowerment and food security. They are consumed fresh, as desserts in after meals, juice or in combination with other food materials. Cucumber production in Nigeria is majorly for local consumption, although Nigerian cucumbers are sometimes exported to neighbouring countries of West Africa like Chad, Cameroun, Niger and Benin Republics. Due to its importance, it ranks among major horticultural crops cultivated in Nigeria. Others are citrus, mango, African star apple, watermelon, banana, avocado pear and pineapple rank among major crops in Nigeria. Like most vegetables, its production is profitable due to high amount of cash income per unit area compared to some other crops. Cucumber production in Nigeria is usually under small scale production. Although commercial (large scale) production is also practiced under plantation farming. Some factors limiting the productivity of Nigerian soils for cucumber production include low fertility, slope, poor effective depth, stoniness/high gravel content and low nutrient/moisture retention. Good agronomic practices such as regular weeding, timely irrigation, fertiliser application and prompt harvesting are necessary for the attainment of high yield and production of quality fruits.

1.1 Factors affecting cucumber production in Nigeria

Several factors affect the attainment of sufficiency in cucumber production in Nigeria. These factors as highlighted by [2–5].

- a. Climate change
- b. Scarcity of improved seeds
- c. Improper or inadequate fertiliser application
- d. Inappropriate spacing
- e. Pest and disease attacks,
- f. Poor storage facilities
- g. Distance to market
- h. High cost of labour/capital
- i. Farm size
- j. Volume of agrochemicals used
- k. Availability of land

1.2 Varieties of cucumber cultivated in Nigeria

According to [6, 7] there are many varieties cultivated in Nigeria. However, it should be noted that not all varieties bear the same quantity of fruit. Farmers obtain hybrid seeds from seed companies or extract seed from previous planting seasons for replanting. This also affects the eventual yield. Available cucumber varieties in Nigeria include

- a. Market more, b) Poinsett, 3) Marketer 4) Ex rantan, 5) Ashley, 7) Royal, 8) Belt alpha, 9) Regal 10) Unbeit. Poinset has high yielding potential among the cucumber varieties cultivated in Nigeria [8].

2. Cucumber production in Nigeria

Cucumber is cultivated in every part of Nigerian agro ecology. This cuts across the rainforest to the savannah zones of Nigeria with the production pattern and volume varying from place to place. The 5 highest cucumber producing states in Nigeria are Plateau, Kaduna, Katsina, Kano and Benue. Others with high production capacity are Enugu, Ebonyi, Akwa Ibom, Oyo, Cross River, Rivers and Nassarawa.

The southern part of Nigeria enjoys between 6-7 months of rainfall, with an average of 1500 mm in the rainforest Zone and > 2000 mm in the Niger Delta region (Bayelsa, Delta, Rivers, Cross River and Akwa Ibom states). In Nigeria, all agro ecological zones support cucumber production but tree crops farming is more commonly practiced in the south due to high rainfall. Many exotic vegetables are produced majorly in the Guinea and Sudan savannah agro ecological zones of

Nigeria, which enjoy relatively low humidity and discourage growth of pest and diseases. Since the southern part of Nigeria enjoys bi-modal pattern of rainfall and a characteristic dry season between October/November of one year and February/March of the successive year, planting of cucumber can be practised all year round being a short duration crop of 45–55 days. Supplemental irrigation may be needed in the both south and northern parts of Nigeria are drought remains an impediment to cucumber production while excessive rainfall encourages build-up of pest and disease. States with high production capacity in Nigeria include Plateau, Kaduna, Katsina, Kano, Benue, Enugu and Ebonyi among others.

3. Production/agronomy

3.1 Climatic requirements

Cucumber requires a warm climate. Optimum day and night temperatures are 30 °C and 18–21 °C respectively. It is relatively vigorous and stand establishment is not a serious problem provided appropriate land preparation is carried out. Furthermore, soil temperature, fertility and moisture must be adequate. A well-drained soil, sandy loam to sandy clay loam is an advantage for the plants to achieve excellent establishment.

3.2 Field establishment and management

Propagation of cucumber could be through direct seeding or transplanting after nursery operations. Transplanting is best done when the ground is still wet enough to support the seedlings after transplant. Cucumber can be grown as monocrops or as intercrops with other arables or with citrus seedlings [9], *Carica papaya* [10]. In intercropping Cucumber with other crops like Pawpaw. It is important to introduce the cucumber before the time of flowering for better nutrient use efficiency by the cucumber [11]. Delayed introduction reduces vigour [12].

Staking is very necessary on the field in order to improve yield. According to [13], staked cucumber performed better than unstaked cucumber. Intrarow spacing of 50 cm -100 cm is recommended [14]. Pruning is also required as it helps to increase light penetration in the farm and reduce build-up of pest and diseases. A spacing of 50 cm × 50 cm is recommended for cucumber cultivation in Nigeria. With pruning, a yield of 571.87 kg/ha was obtained while no pruning produced a yield of 301 kg/ha as spacing of 50 cm × 50 cm gave yield of 581.59 kg/ha. At 50 cm × 100 cm yield obtained was 291.78 kg/ha while 100 cm × 100 cm spacing produced 437.04 kg/ha [15].

3.3 Pest and disease management

Pests and diseases which affect cucumber production in Nigeria include Cucumber mosaic virus, Downy mildew [16]. The variety and type of agrochemical used has strong influence on the reduction of insect pest infestation and severity [17]. Control measures include manual weeding, chemical and physical control measures. These include farm hygiene, manual eradication (depending on farm size) and use of chemicals. Weeding can be done 2–3 times before harvest. Inadequate weeding frequency affect yield significantly through yield decline [18]. It can also serve as weed control if planted as an intercrop. On the other hand, Intercropping of cucumber with Turmeric and Ginger can suppress Cucumber Mosaic Virus [19] while *Solanum torvum* and *Tithonia diversifolia* can suppress

nematodes in cucumber [20]. *Hyptis suaveolens* and *Centrosema pubescens* extracts can also be used for control of cucumber beetles [21].

3.4 Irrigation

Supplemental irrigation may be needed from time to time depending on available soil moisture. According to [22], 20% water deficit is recommended for cucumber production. Mulching is also an excellent practise to help conservation of soil water [23]. Under greenhouse conditions, 12.9 L of water is adequate [24]. Different methods used for irrigating cucumber in Nigeria include sprinkler and drip irrigation. Others are use of watering can (small scale production). In most cases, production of cucumber is under rainfed condition. Irrigation during flowering needs to be done with caution to avoid flower abortion. Irrigation in small scale cucumber farming is recommended in the early hours of the day or evening time to avoid high loss of moisture due to evapotranspiration.

4. Nigerian soils and their management for cucumber production

Nigerian soils show great variability in their properties; from the acid sands of sedimentary rock formation to the basement complex soils and coastal plain sands. pH varies from very acidic (<5 to >7). Constraints include sandiness, shallow depth, acidity (top and sub soil), and low fertility among others. Properties of Nigerian soils selected across different agro ecologies of the country are presented in **Table 1**. The soils have high base saturation but relatively low to medium effective cation exchange capacity and Total exchangeable bases.

Proper management is needed to attain sufficiency in cucumber production. Soil management is the meticulous use of soils through effective and timely combination of factors and practices which can improve soil quality and increase yield. It can be further defined as various activities carried out on the soil to improve and sustain it for optimal productivity in order to enhance food, fibre and timber production. Many agricultural practices affect cucumber producing soils. These include practices such as tillage and planting operations, irrigation, fertiliser application and use of agro chemicals for pest and disease control. Adequate soil management involves the use of soils for purposes for which they are most suited. Requirements for good Soil management includes understanding soil capability for cultivation of various crops, management of problems associated with soils, such as pH, water, fertility and temperature. Problems associated with soil management of Nigerian cucumber soils include inadequate soil survey classification and fertility assessment, lack of communication between land users and government on soil information, absence of conservation practices in farming systems,

State	pH	OC	Tot.N	Av.P	Ex. K	TEB	ECEC	BS
		g/kg		mg/kg		cmol/kg		%
Kano	5.2	9.7	2.4	5.86	0.63	17.61	18.01	99.78
Oyo	5.9	9.4	2.2	9.15	0.14	19.2	19.50	98.46
Imo	4.3	18.3	4.5	1.71	0.11	10.37	15.77	70.21
Kogi	6.1	1.53	0.27	2.84	3.96	13.69	14.25	96.07

Table 1.
Properties of some Nigerian soils.

inadequate knowledge of the environment and over exploitation of soil resources [25]. Sustainable crop production can be undermined or constrained by poor soil management as crop performance is highly related to soil quality.

4.1 Soil constraints to cucumber production and the available management options

4.1.1 Low soil fertility

Due to the inherent low fertility status of many Nigerian soils and poor availability nutrients for plant growth. Cucumber producing soils hardly have sufficient nutrients for plant needs and optimal productivity of crops. Proper soil fertility is necessary as vine length, and other growth parameters affect the eventual crop yield. Therefore, timely and appropriate application of fertiliser is required to improve yield and reduce nutrient mining and soil degradation. Organic or inorganic fertilisers are mainly used for combating soil fertility problem in cucumber production. However, there is strong advocacy for use of integrated soil fertility management (ISFM). Although fertilisers have the potentials to increase yield, there is need for caution as high fertiliser rates could also affect fruit quality [26]. Use of organo-mineral fertilisers is highly recommended as they more compatible with the nature of our soils due to their slow release pattern and environmental friendliness considering the high sand content of Nigerian Cucumber producing soils.

Examples of fertilisers used in soil fertility management in cucumber production can be broadly grouped into

- a. **Organic sources:** Farmyard manure e.g. poultry manure, cow dung, compost, household waste are good sources of fertiliser for cucumber. Others are poultry manure and pig manure [27]. Application rate of 5-6 t/ha poultry manure is recommended in the Northern Guinea savannah of Nigeria [28], 35 NPK 400 g/N/ha) [29]. Odeleye et al. [30], recommended 5 t/ha in the inland valley, of SWN and 10 t/ha for upland soils. For the arid zones, 120 kg/ha Poultry Manure is adequate, while 80 kg/ha cow dung is suitable [31]. Other soil fertility improvement option include the use of cassava peel and use of organo mineral fertiliser [32], 20 t/ha PM is suitable in Kano [33].
- b. **Inorganic sources:** NPK, Urea, Phosphate and potash. 50-60kgNPK/ha is recommended for the Northern guinea savannah zone [34]). According to [35], cucumber production in Nigeria requires 130 kg/haN, 95 kg/ha P₂O₅ and 200 kg/ha K₂O. It is however important to note that fertiliser application should be based on soil test results. Fertiliser should be best applied at 3–6 WAP [36].
- c. **ISFM:** Integrated soil fertility management is considered most appropriate for management of cucumber producing soils of Nigeria. ISFM strategies that can be used to manage soil fertility problems in cucumber production in Nigeria include use of appropriate farming systems and planting of companion crops such as marigold to suppress soil pathogens [37] timely and adequate application of fertilisers, use of cover crops and mixed cropping to allow organic matter accumulation, use of organic manure, compost and organo mineral fertiliser, adequate irrigation to help soil processes, crop rotation. Integrated soil fertility management is the best approach to managing soils under cucumber [38].

4.1.2 Soil temperature, soil water and soil compaction

Soil water is critical to crop production just as fertiliser and other factors of production. Soil fertility depends on soil water, temperature and soil density because fertiliser sources need to decompose or dissolve depending on their source (organic or inorganic) in order to make nutrients available to plant. Similarly, microbial activities which are necessities in soil fertility economy are hampered by soil temperature and density. Strategies used to manage soil temperature, water and bulk density include.

- a. **Mulching:** Mulch is any materials used to cover soil surface in order to reduce evaporation, weed infestation and action of rain and wind. Mulch materials may be natural or synthetic. Soil physical properties such as temperature, water and bulk density can be managed by using biological mulch (plant residue and fresh plant parts). Biological much tend to improve better than synthetic mulch. Other management strategies include conservation tillage, use of cover crops, application of manure, compost and organic mineral fertiliser in order to increase soil organic matter base.

4.1.3 Soil erosion

Soil erosion, which may be in form of water or wind erosion, constitutes a serious agent of soil degradation and limits the availability of nutrients and soil water. Exposure of soils to the vagaries of weather and climate, increasing population density, increase in proportion of land under cultivation, cultivating lands not suitable for cultivation has caused erosion problems. Erosion causes a reduction in soil volume, lowers crop yield, increases run off and decrease in the density of vegetation. Strategies used in combating erosion include avoidance of cultivation on sloppy lands or in cases of cultivation on sloppy lands; within land ridges should be avoided. Other strategies that can be used include terracing, contour ploughing and use of Vetiver technology [39]. Vetiver grasses can be planted in cucumber farms to help stabilise soils and reduce erosion. Other methods include proper spacing, crop rotation and use of natural mulch materials to reduce the effect of torrential rain drops on soils in Nigeria.

5. Conclusion

Cucumber production in Nigeria is an ever expanding enterprise because of their nutritional and economic uses. Poor soil management leads to decrease in production. Therefore, adoption of certain soil management strategies such as use of cover crops, conservation tillage, use of mulch and vetiver grass technology could be effective soil stabilisers. These management strategies should be adequately adopted and appropriately applied for sustainable cucumber production in Nigeria.

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Author details

Bernard Ndubuisi Okafor* and Japhet J. Yaduma
National Horticultural Research Institute (NIHORT), Ibadan, Nigeria

*Address all correspondence to: kpakpando2001@yahoo.com

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