



IRRIGATED CROP PRODUCTION FOR FOOD SECURITY: THE ROLE OF LEGUMES

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ABSTRACT

Especially in the savannas where the bulk of crop production is carried out in Nigeria, production of crops is declining due mainly to reduction in the amount and duration of rainfall caused by global changes in weather patterns attributed to global warming. In such areas yield losses of fifty percent have been reported. The rain fed production of crops usually faces mid or late season drought which can adversely affect growth and development of crops. Moisture stress during critical stages of crop growth results in reduction of leaf area thereby reducing photosynthetic and crop growth rate. Currently less than 5 percent of the arable land in Africa is under irrigation compared with around 30 percent in India and higher in developed countries. But in the wake of the drought in many parts of Africa, irrigation has emerged as a high priority investment that is being justified for its contribution to increasing the security of food production, rural employment generation and foreign exchange earnings. Presently Nigeria is listed by FAO among those nations that are at the moment technically unable to meet their food needs from rain fed production (FAO 2010). Typically rain fed crop production in Nigeria is subsistence in nature, mainly small holder based with farm sizes ranging from 0.1ha to slightly above 1ha, and characterized by low and or insufficient inputs. This ultimately results to low output. Irrigation offers opportunity for increased crop production through increased in land area devoted to production and cropping intensification.

KEYWORDS: savannas, rainfall, global changes, stress, photosynthetic, crop production.

INTRODUCTION

Irrigation, the artificial application of water to crops makes crop production agriculture possible in areas unsuitable for intensive crop production. Its major significance is that it transports and provides water to crops thus increasing the yield. In some cases, it aids by acting as a supplementary source of moisture and aids in completing the production cycle. The use of irrigation provides an important management tool to maintain rapid plant growth and pod development. Rainfall alone is usually not adequate and often does not occur at the right time. Studies have shown that yields can be enhanced by 10 to 40% through the use of irrigation, especially during drought years. To prevent malnutrition, a diet must provide both sufficient calories and correct nutritional balance. Cereals while being excellent sources of energy in form of starchy foods are however in comparison poor sources of protein. The protein of grain legumes such as groundnut contains substantial amounts of some of the essential amino acids lysine and tryptophan which compliment the protein supplied by cereals. The World Food Summit 1996 defines food security as "Food security exists when all people, at all times have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" Important aspects of the definition are food availability which refers to "the availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports" and utilization which encompasses "utilization of food through adequate diet, clean water,

sanitation and health care to reach a state of nutritional well being where all physiological needs are met" (FAO 2006). The problem of food security is exacerbated by the rapid growth of population and hence demands for food. Presently prices of food are rising due mainly to declining farm outputs. Having serious consequences on food production is climate change which is capable of influencing the variability of weather and thus on food production. Of the various regions of the world, Africa appears to be worst hit having the twin problem of over and rapidly increasing population and environmental issues. Almost 600 million people are living in Sub Saharan Africa; of this figure about 166 million live in Nigeria, and this figure is expected to double by 2020. This region is most vulnerable to food security issues. Especially in Africa in general and Nigeria in particular, irrigation can and should play an important role raising and stabilizing food production (FAO 2004), while the inclusion of legumes in irrigated cropping systems will go a long way towards solving some of the nutritional problems of majority of the populace (Mukhtar, 2011). This paper examines the extent of irrigated agriculture in Nigeria and legumes cultivation under irrigation and their contribution to food security.

Agriculture and Food Security

According to FAO (2002), the world agricultural production can grow in line with demand, provided that the necessary national and international policies to promote agriculture are put in place. Global progress in

food security and nutrition is expected to continue, in parallel with a reduction in poverty as projected by the World Bank. The incidence of undernourishment is expected to fall from 17% of the population of developing countries at present to 11% in 2015 and 6% in 2030. Yield growth will continue to be the dominant factor underlying increases in crop production in the future. In developing countries, it will account for 70% of growth in crop production up to 2030. Overall, it is estimated that some 80% of future increases in crop production in developing countries will come from agricultural intensification. Agriculture employs over 50% of the total population in developing countries (Dabour 2002). In Nigeria agriculture employs about two thirds of Nigeria's labour force, contributes over 40% of the gross domestic product provides about 88% of nut oil earnings. The crop subsector alone contributes 85% of the agricultural GDP. Over 90% of the Nigerian agricultural output is accounted for by small scale and subsistence farmers with farm holdings ranging from 0.5-3.5 hectares. The total cultivable land in Nigeria is estimated to be 68 million ha representing 66 percent of the total area of the country. 2002 estimates indicated 33million as actual cultivated area in the country (FAO 2005).

Irrigation and Food Security

Productivity and incomes can be enhanced by improving quality of seeds and farm management practices such as land and irrigation management practices which vary substantially across agro-ecological zones. Furthermore, increasing the area under irrigation will expand output since crop yield under the irrigation system is much higher than under rain-fed system

Irrigation is an essential component of the modern package of inputs along with improved seed, fertilizer, crop protection and improved tillage. There are many benefits of irrigation. These include: assurance of seed germination, water is availability throughout the growing season, production risks are minimized, soil-applied pesticides are activated, pods mature uniformly, Nutrient uptake is enhanced, heat stress is reduced and crop maturation occurs more evenly. According to FAO (2004) total area equipped for irrigation stands at 293,117 ha out of which about 218,800ha is actually irrigated. The development of irrigation schemes in Nigeria has been constrained by the high cost of irrigation schemes so far constructed and the management of such schemes consequently leading to poor utilization of such schemes. The high cost of establishing irrigation schemes in Nigeria (costs from USD 11,200/ha for the lower Anambra Irrigation Project to USD13, 000/ha for the Kano River Development Project) could be a factor militating against establishing and maintenance of public irrigation schemes. Management of existing irrigation is poor due mainly to a lack of maintenance culture. However, some degree of success has been achieved in areas where irrigation facility is farmer operated. All leading agricultural countries depend on irrigation systems for their farming activities to enhance productivity and sustain a year-round farming. However, crop production in Nigeria has remained largely rain-fed dependent with minimal irrigation practices. For instance, less than 1% of Nigeria's arable land is irrigated. This is almost insignificant when compared with countries

like Indonesia, Malaysia, Thailand and Brazil that have irrigable arable land of 12.36%, 4.81%, 28.19% and 4.38% respectively.

Legume crops and food security

Next to cereals, legumes are the second most important group of crops in the world. Of importance is the ability of legumes to fix atmospheric nitrogen. This feature sets them apart from other plants. This can be directly attributed to a legume's ability to supply most of its own nitrogen needs with the help of symbiotic *Rhizobia* bacteria living in their roots. Legume crops cultivation also has influence on soil characteristics. Soil quality benefits of legumes include: increasing soil organic matter, improving soil porosity, recycling nutrients, improving soil structure, decreasing soil pH, diversifying the microscopic life in the soil, and breaking disease build-up and weed problems of grass-type crops. Usually about two-thirds of the nitrogen fixed by a legume crop becomes available the next growing season. The beneficial effect of legumes on succeeding crops is normally exclusively attributed to the increased soil N fertility as a result of N₂ fixation. The amount of N₂ fixed by leguminous crops can be quite high, as high as 100kg/ha. Legume plant and seed tissue is relatively high in protein and oils. Protein content of most grain legumes vary from 22 – 28% while the oil content vary from 52- 65%. Legumes play an important role in the traditional diets of many regions throughout the world. They have relatively low quantities of the essential amino acid methionine but are high in the essential amino acid lysine. Legumes are low in sugar and fat. Their nutritional value plays an important role in maintaining the overall health of a person as they are packed with iron, vitamins, proteins, oil, fibre and starch. Crop production in Nigeria is dominated by cereal, root and tuber crops. The cultivation of legumes does not receive the attention it deserves. Under irrigation, the production of high value horticultural crops such as vegetables and fruits with irrigation appeared to have a competitive edge over other row crops such as rice, maize, groundnut, cowpea and soybean. Improved irrigation allows for the increased production of many crops. With irrigated land being less than 1% cultivated area, the contribution of irrigated agriculture to total crop production is small (FAO 2005). The contribution of legumes in irrigated crop production is even less so. This is in spite of the many advantages of legume production in the improvement of diets of the rural poor and undernourished. The impact of irrigation is felt with regards to specific crops such as wheat, rice, sugarcane and vegetables with little or no inclusion of leguminous crops in the rotation. The recent past has seen improved cultivation of such crops as cowpea, groundnut and soybean with irrigation. Legumes can be used as rotation and sequential crops with other crops such as cereals, tuber and root crops. The inclusion of legumes in irrigated cropping systems has many advantages which include; improved soil fertility status by breaking the cereal-cereal, cereal-horticultural crops cycle, income generation, employment *etc.*

Groundnut (*Arachis hypogaea* L.) is grown on nearly 23.95 million ha worldwide with the total production of 36.45 million tons and an average yield of 1520 kg/ha in 2009 (FAO 2011). Groundnut has a high content of edible

oil, which ranges from 50 to 65% (Taira, 1985; Boye-Goni *et al.*, 1990) and protein content ranging from 25 to 35% (De Waele and Swanevelter, 2001; Anonymous 2002). This makes it a popular human food and source of cheap protein. Groundnut seed can be consumed fresh, boiled, steamed, roasted, fried or as ingredients in other foods. The nuts are shelled and crushed to obtain vegetable oil used for cooking. Groundnut cake a by-product of crushing is used as a protein supplement in livestock feeds. The cake has very high protein content (48-50%), (De Waele and Swanevelter, 2001). Groundnuts are used to fight malnutrition. Some high protein, high energy and high nutrient groundnut pastes have been developed for use as therapeutic food aid in famine relief by international organizations like WHO, UNICEF, Doctors without Borders, etc

Cowpea (*Vigna unguiculata* [L.] Walp.) is an important grain legume as it is a major source of dietary protein for the people. Soil, water, and nutrient management practices are inadequate to sustain food production and to meet the food requirements of the fast growing population. The increase in cowpea productivity in the cropping systems will improve the nutrition of people, increase the feed quantity and quality. Cowpea grain contains about 22% protein and constitutes a major source of protein for resource-poor rural and urban people. It is estimated that cowpea supplies about 40% of the daily protein requirements to most of the people in Nigeria. Soybean is a major industrial and food crop cultivated all over the world. Area devoted to its cultivation in Nigeria has increased as a result of its nutritive and economic importance and diverse domestic usage. It is also a prime source of vegetable oil in the international market. Soybean has an average protein content of 40% and is more protein-rich than any of the common vegetable or animal food sources found in Nigeria. Soybean seeds also contain about 20% oil on a dry matter basis, which is 85% unsaturated and cholesterol-free. Although the oil is used primarily in edible products such as margarine and cooking oil, it is used industrially in such products as high-grade paints and pharmaceuticals. The soybean oil meal that remains after the oil is extracted is almost all used as a high protein livestock feed but the meal can be further refined to give various protein extracts for direct human consumption.

SUMMARY

Irrigation has long played a key role in feeding expanding populations and is undoubtedly destined to play a still greater role in the future. It not only raises the yields of specific crops, but also prolongs the effective crop-growing period in areas with dry seasons, thus permitting multiple cropping (two or three, and sometimes four, crops per year) where only a single crop could be grown otherwise. With the security provided by irrigation, additional inputs needed to intensify production further (pest control, fertilizers, improved varieties and better tillage) become economically feasible. Irrigation reduces the risk of these expensive inputs being wasted by crop failure resulting from lack of water. The practice of irrigation consists of applying water to the part of the soil profile that serves as the root zone, for the immediate and subsequent use of the crop. Well-managed irrigation

systems are those which control the spatial and temporal supply of water so as to promote growth and yield, and to enhance the economic efficiency of crop production. Such systems apply water in amounts and at frequencies calibrated to answer the time-variable crop needs. The aim is not merely to optimize growing conditions in a specific plot or season, but also to protect the field environment as a whole against degradation in the long term. Only thus can water and land resources be utilized efficiently and sustainably. On the other hand, poorly managed irrigation systems are those which waste water and energy, deplete or pollute water resources, fail to produce good crops and/or pose the danger of soil degradation. The vital task of increasing and stabilizing food production in drought-prone regions must therefore include a concerted effort to improve on-farm water management. Some traditional irrigation schemes need to be modernized so as to achieve higher yields as well as better resource utilization. New schemes being planned should likewise be based on sound principles and techniques for efficient water use and for optimizing irrigation in relation to all other essential agricultural inputs and operations. Thus sustainable cropping systems which are capable of sustaining maximum producible yields are therefore desired if the teeming millions are to be fed. Such systems while maximizing yields should maintain the productivity of the soils as well as provide food of desired quality for man's benefit.

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