

Millet the Promising Crop of the Climate Change

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Abstracts

Climate has been causing serious environmental hazards ranging from low soil water, erosion, droughts, and high temperatures in agrarian rain fed areas Nigeria which the resource poor farmers are not able to cope with as a result of poverty and low technological development. It is projected that crop yield in this area may fall by 10-20% by 2050 or even up to 50% due to climate change. Large potential productivity gains are possible in this zone, given the soils, crops and climates that are favourable. Simple rain water-harvesting technique can be useful to bridge short dry spells if supported with the crops that are more adapted to the condition.

Keywords: Millet, promising crop, climate change

Introduction

Climate change causes unpredictable and extreme weather events impact and increasingly affects crop growth, availability of soil water, soil erosion, droughts and dry spells, floods, sea level rises with prevalent infection of diseases and pest infestations (Adejuwon, 2004; Zoellick and Robert 2009). These environmental problems result to low and erratic crop yields, which invariably make farmers more susceptible, especially in African dry zones (Ziervogel *et al.*, 2006). The growing problem of climatic change impacts though global, the developing countries, especially the dry lands of Northern Nigeria will be most extremely affected. This is because the economy of the region is predominantly agrarian rain-fed. The farmers in this are not able to cope largely because of serious poverty level and low technological development, hence low level of coping capabilities (Ziervogel *et al.*, 2006; Nwafor 2007; Onyenechere 2010). It is projected that crop yield in Africa may fall by 10-20% by 2050 or even up to 50% due to climate change (Jones and Thornton, 2002) while food demand will increase by 70 to 90% (de Fraiture *et al.*, 2007).

Available evidences showed that Nigeria is already being plagued with diverse ecological problems which have been directly linked to the on-going climate change (Adefolalu, 2007; Ikhile, 2007). The southern ecological zone of Nigeria largely known for high rainfall is currently confronted by irregularity in the rainfall pattern while Guinea savannah experiencing gradually increasing temperature. The Northern zone faces the threat of desert encroachment at a very fast rate per year occasioned by fast reduction in the amount of surface water, flora and fauna resources on land (FME, 2004; Obioha, 2008). The resource poor farmers of the region are among the poorest and most food insecure in the world faced with the prospects of tragic crop failures which reduced agricultural productivity, increased hunger, poverty, malnutrition and diseases (Zoellick and Robert 2009; Obioha, 2009).

Relying on rainfed agriculture poses substantial risks to farmers because of high temporal and spatial variations. Harvests are always at risk because of frequent short dry spells during the growing season, which reduce the volume of yields even in the years high rainfalls were recorded (Barron *et al.*, 2003). They also have an indirect impact on cultivation, as farmers are less likely to invest in inputs at commercial level due to the high risk of crop failure. Farmers in these areas struggle to survive using subsistence cultivation methods. Tragically, they are missing out large potential productivity gains that are possible, given the soils, crops and climates that are favourable.

These risks and uncertainties can be reduced by adopted simple water-harvesting techniques that are useful to bridge short dry spells and supporting the crops that are more adapted to the condition. Hence, concerted efforts should be geared toward tackling these menaces are indispensable. The objective of this paper is to review the potentials of rain fed pearl millet in the dry sub humid agro ecological zone of Borno state where the crop is the most popular food crop.

Millet the Promising Crop

Pearl millet (*Pennisetum glaucum*) is the most important dry land food crop of West Africa (Rowland, 1993). Ojedran *et al.*, (2010) ranked pearl millet as the most important cereal in the dry sub-humid and semi-arid zones of Nigeria. The main millet producing countries in West Africa in 2000 were Nigeria with (54%), Niger (20%) and Mali (9%). In Borno state, pearl millet is the main staple food and is dominant in the agricultural production systems. The crop is annually grown on more than 29m hectares in the semi and tropical regions of Asia and Africa. India is the largest producer of this crop both in terms of area with (9.1m hectares) and production of (7.3

metric tons), with an average productivity of 780kg/ha during the last five years (www.icrisat.org, 2007). CGIAR (2011) reported that over the past years, the developing world has favoured three main crops: rice, wheat and corn. These crops are forced into more arid areas where they require enough soil water to grow, produce lower yield and are more susceptible to droughts and other climatic changes. It is even more unfortunate that over time these new crops also reduced the demand for the more traditional dry land crops like millets and sorghum. With a drop in demand, some farmers stopped cultivating these traditional crops, even though they were much better suited to their arid environment. These traditional dry land crops like millets and sorghum are only cultivated at subsistence level today. Farmers grow these crops only to feed their families and not for commercial purposes. With less production and less market demand, there is less justification for investment in dry land crops. Unfortunately less resources were allocated for the research, development, support services and infrastructure needed to commercialize them, resulting in even further declines in production level.

Soil water is among other problems has been a limiting factor for its optimal production of pearl millet. It has the potential of producing high total grain yield for the increasing population in this region under an ideal situation. Pearl millet is a nutritious crop, producing almost all the required nutrients needed by humans. Filardi *et al.* (2005) reported that pearl millet produces higher protein levels than other grains and have approximately 85% of the energy content compared with corn.

Pearl millet crop had been grown for over 5000 years all over the Sahel and the tropical countries of West Africa and is the crop plant best adapted to arid and semi-arid zones. It is the major staple food crops for over 50 million of poor and vulnerable people in the Sahelian and Sudanian zones of West Africa (IRD, 2009).

Development and cultivation of improved farmer-preferred cultivars with specific adaptation to the environments the grain can significantly contribute to food security in this region and the world at large. The ability of pearl millet to grow in dry and marginal environments clearly makes it a crop with an important role in the future. It is extremely resistant to drought and well adapted to poor soils with high resistance to diseases and pearl millet remains the only crop that has promise of food security for the growing world population under the changing climate. It seems likely to spring back as the world's best crop as the world gets hotter and drier. CTA (2008) pointed out that the earth's temperature has risen by 0.74°C in just one century. NRC (1996) described pearl millet as tough as it produces grain and fodder under very hot and dry conditions and on poor soils to poorest soils make it impossible to beat in the world's harshest agricultural production environments, pearl millet can withstand drought, heat, insect and flash flood. Hussein *et al.* (2008) reported that pearl millet yields reliably in regions too hot and too dry to support good yields of corn and sorghum. NRC (1996) stated that its combination of rapid growth rate when conditions are favourable, high temperature tolerance and ability to extract mineral nutrition and water. The optimum rainfall requirement of pearl millet ranges between 350 to 500mm and Chiroma *et al.*, (2006) identified the boot and grain fill stages are important stages when pearl millet is particularly sensitive to water stress.

Overcoming Africa's stagnant dry land food production trend requires the growth, expansion and diversification of markets for dry land crops, so that farmers will be rewarded for increasing their production and productivity. In recent years, new major trends show that an increasing demand for dry land cereals has begun to emerge which in turn will provide a renewed opportunity for sorghum and millets in the marketplace. These are long-term trends based on fundamental increases in the underlying factors that drive demand. Increasing global demand for livestock products (meat and milk) with growing global affluence, residues as well as grains are vital feed stocks for cattle, goats and chickens. The increasing demand for livestock products will overstretch corn supplies and therefore accelerate demand from sorghum and millets as livestock feeds. This strong demand is increasing the market value of crop residues. Further, pearl millet grain is also a valuable animal feed, comparable to corn for poultry but with a higher protein content and better balanced amino acid profile so less protein concentrate is required in a pearl millet based feed ration.

Pearl millet grain is also highly valued as a human food especially by those engaged in hard physical work due to its high energy content and slower rate of digestion compared to lighter cereals like rice and wheat. Its relatively slower digestion rate is also advantageous for diabetics.

The challenges for global agriculture in the 21st century are to produce 70 per cent more food by 2050 to feed a projected increased population, while implementing more sustainable methods and responding to climate change (FAO, 2009).

Much concern about feeding the world in 2050 relates to the slower increase in yields of the major cereal crops over the past three decades (Alston *et al.*, 2009). For example, annual increases in wheat yield are shrinking and are now just below 1% (Fischer *et al.*, 2009). Yield growth is considered the major route to meeting future global food demand, through increased potential yield (maximum yield with best varieties and agronomy, and removing constraints) and closing the gap between actual farm yields and potential yields (Fischer *et al.*, 2009).

The dry lands, covering about 41 per cent of the Earth's land surface, will need to contribute their share to this yield increase. Dry lands are limited by soil moisture, the result of low rainfall and high evaporation and show a gradient of increasing primary productivity, ranging from hyper-arid, arid, and semi-arid to dry sub-humid areas,

based on a decreasing level of aridity or moisture deficit (Safriel *et al.*, 2005).

Supplemental Irrigation

To address the needs of the people in the agro-ecology and restore the landscapes, the menace of drought and land degradation needs to be reversed and productivity increased. One viable approach to raising productivity and income under rain-fed agriculture in the agro-ecology is to introduce supplemental irrigation to check the adverse effect of sporadic droughts and long dry spells. Experience of supplemental irrigation on wheat and barley in Jordan, using traditional water resources, have shown that yield improvements are possible and sustainable (Taimeh, *et al.*, 1999). Upgrading rainfed agriculture through better rainwater management holds considerable scope for increased food production and poverty alleviation. Research in Sudan has shown that the yield of millet is more closely related to the number of rain-days than to the seasonal rainfall total (Hess, 1999). Usman (1987) reported that soil and water conservation and management efforts such as practice of supplemental irrigation could be a remedy to yield reduction caused by dry spells in rainfed areas. Oweis and Hachum (2004) in research conducted in West Asia and North Africa confirmed that using irrigation conjunctively with rain was found to produce more wheat per hectare. Supplemental irrigation, according to them is a highly efficient practice with great potential for increasing and improving livelihood in the dry areas. Trials of supplementary irrigation in Burkina Faso, Kenya, Niger, Sudan and Tanzania have also shown increased yields of two to three times those achieved in dryland farming (Sharma *et al.*, 2010). Based on the above review it is hypothesized that supplemental irrigation could play a vital role for yield improvement in the dry sub-humid Maiduguri of Nigeria.

Conclusion

Pearl millet (*Pennisetum glaucum*) is the most important dry land food crop of West Africa and by implementing good agricultural practices the yield could be improved.

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