Literature

1. Ceres: The FAO Review (1996). Engineering power for food security, pp 10. Viewpoint article by Adrianus G. Rijk. March — April, 1996 issue N158 (vol.28, N2).

2. Molin J. P., Bashford L.L. (1996). Penetration forces at different soil conditions for punches used on punch plauters. Transactions of the ASAE, vol. 39 (2): 423 — 472.

3. Yahaya R. / Research report on " Soil bin examinations of soil penetrating components of a harvester for small root crops". University of Hohenheim. Germany. Stuttgart, 1997. 69 c.

AN INTRODUCTION TO FOOD SECURITY IN AFRICA

R.M.Yahaya (BATU)

Food security and self-sufficiency in food production is a major objective of african countries. Within the next 40 years, agricultural productivity must double in order to feed a fast growing population, but without further deterioration of natural resources, especially soils. This objective can be assumed to be true regardless for every climate, but it is of a paramount importance for such sahelian-countries like niger. Therefore sustainable soil management, as postulated in agenda 21 during the 1992 unced conference in rio de janeiro, must be a fundamental component in the cropping systems of those countries. The protection of natural resources, food security and poverty alleviation has to become the principal objectives of national development policies. The german government was among the first countries that ratified agenda 21 illustrating that they attached priority to the issues.

An increase in food production can only be achieved through yield increases on lands already under cultivation. Using appropriate technologies and new agricultural implements such as cereal and root crops harvesting machines in site specific approach is a basic challenge. That is why, many organizations governmental and non-governmental are involved. In the case of rural areas of Niger, one of the main problems meet by small farmers is located within the harvesting of small root crops. Sparingly, of burning the

plant residues according to the traditional method, and destroying soil structure by decreasing soil fertility, new technology could be expected to cut the higher part of the plant and incorporate it into the soil. The use of the proposed technology could help to enhance productivity, maintain soil fertility through erosion control and protect the environment. This procedure belongs in the category of so called low input technology. It allows not only the composition of organic fertilizer in the soil, but also a part of the residue function as mulch and constitutes a very effective erosion control [1].

FAO statistics showed that Africa to meet its food needs in the year 2000, increased production will have to come from increased yield per hectare (51%), rather than from expanded cultivated areas (27%), or from more than one crop per year on the same land (22%). However many researchers continue to advise Africa, to cover its food needs per annum should have to stop the rising population rate (Cairo summit on world over population, 1995). This cannot be the rational solution to the problem. The low annual production growth in the west-African region is attributed to three factors: low soil fertility, limited and untimely cultural operations and frequent drought periods. Therefore soil fertility increasing and new technologies introducing should be an adequate solution.

Many countries in Africa, in their genuine and serious attempt to intensify agriculture and increase their food production, have introduced machinery and equipment, which sometimes were neither tested locally, nor matched with the particular soils to be used. It is increasingly difficult for these farmers to cope with the drudgery of work using small-unimproved tools. In addition, shortage of trained technicians and farmers in the use of the new equipment introduced has had its negative impact: The experiences of the various countries testify to such inadequately planned transfer of technology. In many cases, the targeted yields have not only not been maintained, but serious land degradation has been caused (FAO, 1993).

It is recognized that the major area of agricultural potential in Africa is the Sub-Saharan Africa region. However, during the past 30 years agricultural production in the region has increased by only 2% a year, whilst agricultural exports have declined, and

food imports are increasing at about 7% year (Geoffrey C. Mrena, 1990). Only 30% of Africa's land area are capable of sustained production of rained crops with about one quarter of this currently being used. It is reported that acreage expanded by only 0,7% per annum during the past 20 years. At this expansion rate productivity must rise by more than 3% a year — three times faster than in the past (IBRD, 1989). This is indeed a gloomy scenario.

However, Swaminathan (1986) has compared the current spotlight on Sub-Saharan Africa for struggle against hunger to want several food experts predicated for many countries of Asia and Africa over 25 years ago.

For example, India, was singled out as a hopeless case that could not be saved from hunger and famine today India, has over 30 million tons of grain stock as a food security reserve. In this regard, Swaminathan (1986) and many others are optimistic of similar strides being possible for Africa; an appropriate action plan, involving appropriate technological change, is formulated and implemented.

A survey on potentials for modern mechanization of agricultural exploitation in the Eastern of Niger by University of Hohenheim [2] showed that, Niger Republic has a great potential for special commercial crop production as onion or tiger nut (cyperus esculenta). Small farmers produce and export in West-African countries small root crops as tiger nut (77 000 tons in 1995) and onions (more than 200 000 tons in 1993).

In Niger the inherited low fertility of semi-arid soils is a severe constraint to increase cereal and root crops production. Traditional methods to maintain and restore soil fertility do not seem to be sufficient to ensure adequate yields in this respect. Many projects conducted their research programs on favor of peasants but no one has touched the sick question on how traditional and modern technologies could remedy to the low soil fertility in Niger.

In an article written by Adrianus G. Rijk, chief of FAO's Agricultural Engineering Service and published in the March — April, 1996 issue of Ceres, the FAO Review, he noted that the final report on a FAO mechanization project in China cited a 90%

increase in yield on farmers' fields for a double cropped wheat/maize farming system, largely as a result of the introduction of no-till drilling, planting and harvesting equipment. Such achievements can also be gained in Africa through the development of appropriate machinery and equipment suitable for Africa's environmental and socio-economic conditions. The FAO summit in Roma (Italy) on November, 1996 recommended to the year 2015, produce a food for at least 15 million people. This could be only achieved by using a new technology and new agricultural implements and machines such as harvesting machines and technology for a durable soil conservation. Soil classification and structure should studied before introducing any new technology in Africa.

Soil classification, conditions and texture

There are two zones within the Sub-Saharan Africa regions which have been identified as possible experimental sites, based on a classification by FAO (1979) and Dudal (1980). These zones where classified for soils by differentiating areas of moisture conditions in Africa. They are soils of the humid to sub-humid wooded Savannah zone and soils of the semi-humid wooded to semi-arid Savannah zone. The Niger Republic attributes to the last zone. This zone covers areas between the Sub-humid wooded Savannah zone and the arid zone between latitudes 15 and 20 degrees the North and 15 to 25 degrees the South, where the average rainfall ranges from 200 to 800 mm. The major upland soils are generally found on level to near level topography with isolated low-lying hills (Inselbergs) with mainly shart grass Savannah grading into a desert-like type of vegetation. Such soils are of high clay activity and mostly referred to in the FAO/UNESCO (1977) legend as Aerosols, Luvisols, Cambisols, Arenosols, Rendzinas and Lithosols. In Niger, the regions where agriculture is practicable most of soils are sand.

For tests on soil engaging implements and machines, there are parameters, which can be established to describe soil conditions before and after work has been carried out. These parameters will enable assessment of the quality of the work and the ability of the

implement or machine to satisfy desired criteria. For example, knowledge of soil strength conditions permits to lower the energy requirements; and to achieve this it is necessary to know the soil strength limit for different soil deformation [4].

Particle size analysis, also referred to as mechanical analysis, determines the percentage of the three mineral fractions: sand, silt and clay in the soil and hence its textural class. The texture of a soil is its most permanent characteristic and directly influences a number of other soil properties such as: structure, soil water regime, permeability, infiltration rate, run-off rate, erodibility, workability, root penetration and fertility etc.

Most soils are mixtures of two or more size classifications. In order to classify the soils, many soil survey bureaus use the so-called textural triangle shown in Fig. 1. The particle size analysis of a soil for interpretation on the triangle should be conducted only on that material which is less then 2 mm in size (sand or smaller), and soil should be pulverized or soaked to break down stable aggregates of fine particles. Sieves can fractionate the sand-sized particles mechanically and the portion of each size weighed.

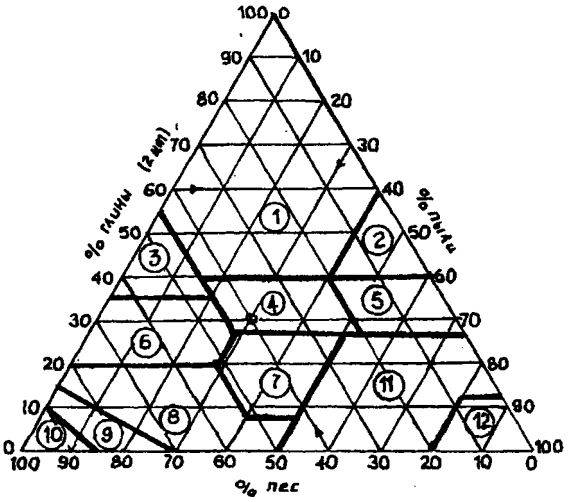

Fig. 1. The USDA textural triangle for classification of soil mixtures

Food security in Africa could be achieved by elaborating new implement and technology, which have been tested in the soil of the target countries. Soil management for yield increasing should be the pre-requested conditions to a sustainable food security in Africa. Therefore no-till has to be introduced in Africa and crop production should be diversified. A part soil management, social stability and political goodwill have to be realized in Africa in order to set a definitive program on food security by our governments.

Literature

1. Geoffrey C.M. (1990) Agricultural Mechanization Policies and Strategies in Africa (case studies from commonweal African countries).

2. Ceres: The FAO Review (1996). Engineering power for food security, pp 10. Viewpoint article by Adrianus G. Rijk. March — April, 1996 issue №158 (vol.28, №2).

3. Molin J. P., Bashford L.L. (1996). Penetration forces at different soil conditions for punches used on punch plauters. Transactions of the ASAE.

4. Yahaya R. / Rapport d' enquete sur "Potentiels pour une mecanisation moderne des exploitations agricoles au Niger ". Study drafted at the ICRISAT Sahelien Centre. Niger. Niamey. 1995. 89 c.

5. Yahaya R., Frick T., Koller K. Direct seeding- current state and its potentials in Eastern Europe // Моделирование и прогнозирование аграрных энергосберегающих процессов и технологий: Тез. докл. науч. техн. конф., Минск, 22-24 апреля 1998 г. / Белорусский государственный аграрный технический университет. Минск, 1998. Ч. 2. С. 133-140.