



Tropentag 2011
University of Bonn, October 5 - 7, 2011
Conference on International Research on Food Security, Natural
Resource Management and Rural Development

**Assesment and Perspectives of Mechanical-power Technology Implementation in
Agriculture in Angola**

Rušarová, K.^a, Mazancová, J.^a, Havrland, B.^a

^a Czech University of Life Sciences Prague, Institute of Tropics and Subtropics, Kamýčká 129, 165 21 Prague,
Czech republic. Email vlkovav@its.czu.cz.

Introduction

Development of agricultural production is influenced by many factors; one of the factors with significant importance is technological level of mechanization. Technological levels of mechanization have been broadly classified as hand-tool technology, draught-animal technology and mechanical power technology (HAVRLAND, 2003). Hand-tool technology refers to tools and implements which use human muscles as the power source. Within rural families in Angola, each family (or more properly, each member that works on field) is holding a European hoe, ownership of machete and axe depends on the family richness. Draught-animal technology uses power of animals, in Angola; oxen (donkeys rarely) are most frequent. Oxen are used for ploughing and transport, seeding and harrowing with animals' employment is almost unknown. The mechanical-power technology is the highest level of mechanization, takes many forms but in the framework of the survey, mechanical-power technology refers to tractor use. The structure of technologies per total arable land area in Angola is the following: 3.1% mechanical power, 25% animal-draught and 71.9% hand-tool.

Average area cultivated by farmers' families in 2007/2008 was 1.56 hectare; in comparison, agricultural companies were farming on average 29.8 hectares – on total 3% of total agricultural area of Angola. In addition, total agricultural area is 3.2 million hectares which represents 2.4% of total area in the country.

The required food balance is reflected by the ratio between available quantity of foodstuff and required amount of the foodstuff to ensure the food for the population. In Angola, the most significant deficits are in production of cereals (55.1% in 2008) and in production of pulses (67.2% in 2008). As a result, Angola is still significantly dependent on food import. This dependency is based on fact that 97% of the agricultural land was cultivated by farmers' families that rarely use different technology than hand-tool. There are two basic possibilities to achieve self-sufficiency in agricultural production in Angola. The first consists in arable land increase as actual arable land represents 2.4% of the total area of the country and 4.8% of the area in Angola is considered suitable for agriculture. The second one, actually the option considered more sustainable, is based on increase of installed power.

Material and Methods

The data collection was conducted in the period from May 2009 to October 2010. Semi-structured questionnaires and interviews were mostly used tools, complemented with collection of

annual reports and acts of the contacted institutions. At the national level, exclusive tractor distributors for Angola (Mahindra, New Holland and Massey Ferguson), Ministry of Agriculture and Mecanagro headquarters were contacted. For the provincial level survey part, Bié province was chosen; institutions approached included Provincial Directory of Agriculture, Mecanagro, private contractors, agricultural technicians, tractor owners and mechanics, village leaders and farmers. Resulting from almost 30 year of civil war when many areas have been inaccessible and with bad communication for long time periods, statistical data for Angola are significantly incomplete. As an example, FAO statistical database (FAOSTAT) has updated data for mechanization only in April 2011 (still, data about tractors are missing), before data on the machinery use in Angola were not changed for more than ten years. As a result, no serious survey related to this issue has up-to-now been realized.

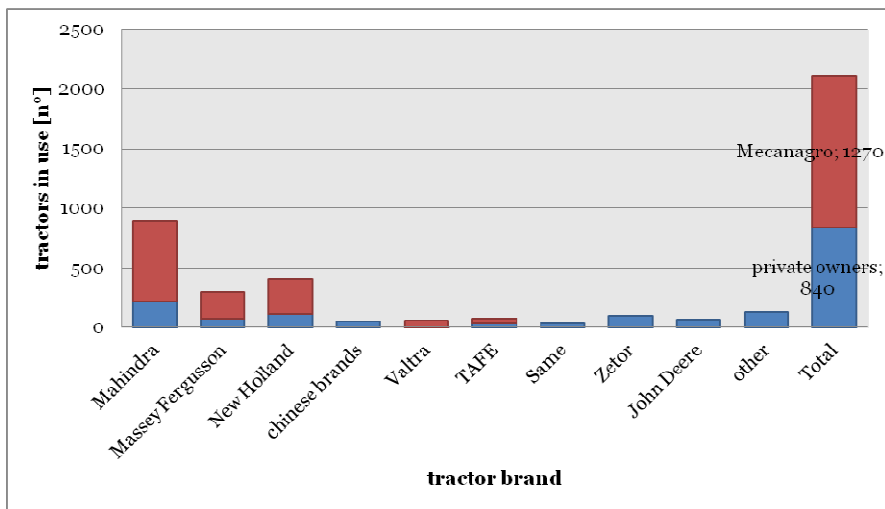
Energy employed in agricultural production (using man-labor, draught animals or machines) can be characterized according to installed power (kW/ha) which is categorized to three grades: grade I – 0.1-0.3 kW/ha, grade II – 0.3-1.5 kW/ha and grade III – more than 1.5 kW/ha. Technological processes take 48% part of total energy consumed in the agricultural processes. Energetic inputs needed to cover food production self-sufficiency of the country were calculated considering required production of staple crops (cereals and pulses) to achieve the above food self-sufficiency. For every percentage of increase in gross agricultural output, an energy input growth of 3% is necessary. (HAVRLAND, 2003)

Results and Discussion

The structure of the machinery park in Angola has changed every year, as the assortment is very fast. There are significantly negative factors that impact valuable utilization of the mechanization and above all life-time of the machines. The most significant internal factors are lack of spare parts, lack of the qualified mechanics and machines' operators, lack of the maintenance and reparation facilities poor maintenance resulting in irregular or no-change of lubricants, unsuitable use of tractor (such as overloading not compatible to the traction power), use of unsuitable lubricants and fuels. Most significant external negative factor that influences slow increase of mechanical soil preparation is presence of mines which are widely spread in some Angolan regions as residue of the civil war. The reasons for internal factors described above are various: The governmental organization Mecanagro has not organized regular trainings for its technicians yet. Tractor distributors interviewed during the survey implement fast training (up to 6 hours) for their clients – owners of medium- or large-scale farms – although they usually do not practice any machinery maintenance. There are some driving schools providing courses of tractor driving and maintenance but their theoretic as well as practical lessons are focused usually only on cars, tractor design and maintenance take minimal part at practical lessons. In addition, the course (where majority of lessons are theoretical and not obligatory) is very expensive in comparison with the average salary, its price is about 790 USD driving license not included (paid separately at the level of about 620 USD).

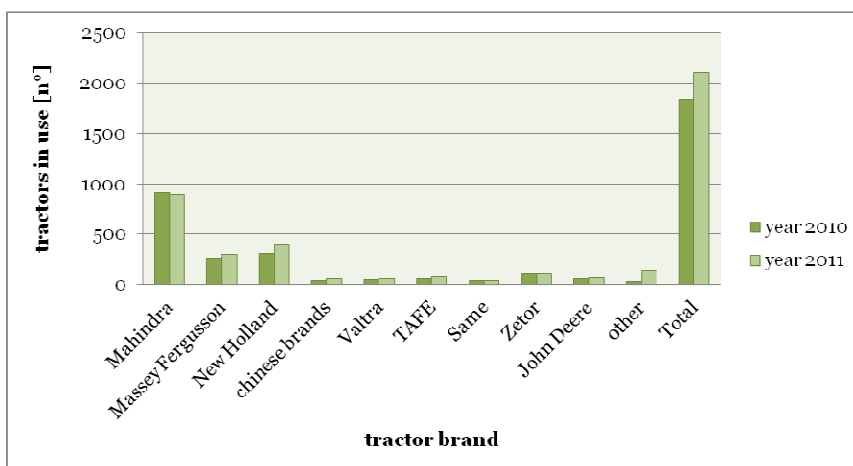
In the period 2005-2008, almost 90% of the tractor park was replaced each year, resulting from spare parts' lack, as well as general poor quality of the imported tractors – Mecanagro received only chinese brands YTO, DongFeng, JinMa, other brands' total share did not exceed 5%. Since 2008, Mecanagro has distributed tractors Mahindra, Massey Fergusson, New Holland, VALTRA and TAFE. These brands are predominantly working about two years and is estimated that their quantity will increase. Tractor brand structure, connected with distribution according to owners is shown in Figure 1.

Figure 1: Tractor brand and ownership distribution



Use of tractors in Angola is largely connected with Mecanagro – specialized division of the Ministry of Agriculture responsible for machines, their distribution over the provinces, machinery repair and maintenance. Private holders, according to the Mecanagro reports and bolletims, owned 350 tractors in operating condition in the period 2007 – 2008. Considering the information obtained by interviews with the tractor distributors, every year about 230 tractors are sold to the landholders. With some deductions due to amortization and local severe working conditions, the annual growth of the tractor number in operable status owned by the landholders can be about 120 units, resulting in 710 units estimated in 2011. Quantity of tractors sold by Mecanagro to their own technicians is prevailed as constant at the level of 100 units in operable conditions. The overall Mecanagro machinery park of tractors in 2009 reached 1,176, more actual data was not available but regarding interviews and observations (and financial crisis), in 2011 is estimated 1,300 tractors as operable. Thus, the total number of tractors in operable status in Angola for 2011 is estimated at 2,110 units. In comparison with the data obtained through the survey, the FAO statistical database FAOSTAT indicated 9,000 tractors in Angola for the period of 2000-2007 (available until December 2010) which is far more. Actually, FAOSTAT releases only manual estimation of agricultural tractors import (e.g. 2,542 units in 2007, 3,266 units in 2008) which is found disputable in comparison with the survey. Figure 2 represents tractors in operable conditions for 2010 and 2011.

Figure 2: Tractors in operable conditions for 2010 and 2011



The arable land in Angola is estimated at 3.2 million hectares which represents 2.4% of the total area of the country. When a total of 2,110 tractors in operable status is considered, the ratio of tractors per 1,000 hectares of arable land is 0.66 or one tractor refers to 1,517 hectares of arable land. In the last documented agricultural season 2008/2009, 316 tractors were used for cultivation of 24,519 hectares which was 77.6 hectares per one tractor.

In the case of farmers' associations in Bié province, no tenure of tractors was proved. Cultivation by mechanical-power technology is very rare, only 1% of individual farmers can afford rent of a tractor, average area cultivated – ploughed – is 2.5 hectares. Associations and cooperatives have no conditions to buy mechanization, even small up to 5 HP which, without no knowledge of mechanical-power technology use approach in Angola, can be considered as very suitable for agricultural associations. Spreading of animal traction use is more actual and, at the same way, connected with many problems: credits for oxen supply are hardly affordable etc.

The total power of tractors in Angola in 2011 is estimated at 127.51 MW, thus the power of an average tractor in Angola is 60.15 kW. Taking into account 3.1% of total arable land cultivated by mechanical power which is 99,200 hectares and total tractor park power of 127.51 MW, the installed power is 1.29 kW per hectare. As a result, the installed power of tractors in Angola is categorized to grade II but refers to small part of the total arable land.

To satisfy population food requirement, there was need to increase the productions of cereals by 58.2% and of pulses by 43%. With consideration of HAVRLAND statement (2003), energy inputs should increase by 174.6% in the case of cereals and 129% in the case of pulses. In total it is 165.9% increase of the energy input at the same arable land area. The resulting energy input requirement would be 0.74 kW per hectare, thus, installed power of technologies would be 0.36 kW which is grade I (comparing actual 0.2 kW). Thus, lack of power is 476.35 MW which can refer to 8583 tractors of 55.5 kW (75 HP).

Conclusions and Outlook

Increase of mechanical-power technology, as the highest level of mechanization, plays a significant role in the agricultural development. In the case of Angola, use of this technology is very limited due to several negative factors. Broader expansion of mechanical-power technology share in the cultivation which is needed to assure population food requirement and desired production oriented on export should be provided. The expansion can be achieved by various arrangements and improvements. Significant increase of tractors' quantity seems to be the easiest solution. Certainly, more tractors are necessary for the mechanical-power technology dissemination which can be achieved by increased tractors' capacity work (actual 77.6 hectares is very poor) as well. Consequently, increased reliability and work capacity would be reached by improved tractor maintenance, effective tractor use in agricultural operations, well developed logistics of activities and reparations. These attitudes can be achieved only by improved capacity building – without proper education, current situation of poor mechanical-power use can never change. Courses should be focused on proper tractor use within specific agriculture activities in the conditions of Angola, periodic tractor maintenance and basic repairs; they are recommended to be as most practical as possible, as tractor drivers and technicians have a decreased literacy level. In addition, more durable tractors of higher life expectancy suitable for conditions of Angola are recommended, especially Massey Ferguson, New Holland, Valtra and Zetor brands, simple models with minimum electrical parts are highly recommended. Long-term loyalty to chosen brands would be favorable for reasons of spare parts' availability and technicians work facilitate.

Regarding problems with general use of tractors in Angola, implementation of mechanical-power technology within farmers' associations is considered as unsuitable, actually. Its application will be suitable only with requirements fulfillment of mechanical-power

technology application general improve at the level of Mecanagro as supporting organization for agricultural mechanization in Angola.

Acknowledgment

The study was financed through the development project No. 279028/2009-ČRA “*Support of Agricultural Secondary School in Bie Province, Angola*” of the Czech Development Cooperation in Angola.

References

1. Faostat. Statistical database. Available online: <http://faostat.fao.org/site/576/default.aspx#ancor>, accessed on 28 August 2011.
2. Havrland, B.; Kapila, P.F.; Krepl, V.; Muñoz, Jans J.O.; Srnc, K.. 2003. *Agricultural Technologies in the Tropics and Subtropics*. Czech University of Agriculture Prague, Prague: 13,16-27,40,45,50-57.
3. MecaInforme. *Informative Bolletim of Mecanagro*. January 2009. Vol.5: 2-11.
4. MECANAGRO-E.P. July 2009. *Balance of the Soil Preparation Campaign, Agricultural Season 2008/2009. (Balanço da Campanha de Preparação de Terras, ano agrícola 2008/2009)*. Viana.
5. Ministry of Agriculture. October 2009.: *Base of Central Database about Agriculture and Alimentation. Base de Dados Central sobre Agricultura e Alimentação*). COUNTRYSTAT/FAO Project. Luanda.
6. Ministry of Agriculture. January 2009. *Results from Agricultural Campaign 2007/2008. (Resultados da Campanha Agrícola 2007/2008)*. Luanda.
7. Ruserova K., Havrland B., Mazancova J., Ciboch H., 2010. *Agricultural Technology Development Strategies in Angola - Prognosis for the Period 2010-2020*. Agricultura Tropica et Subtropica, Czech University of Agriculture. Vol.43 (4): 76-83.
8. Ruserova K., 2010. *Tractor Park Analysis in Angola* (M.Sc.Thesis). Czech University of Agriculture.