

A Look to the Mechanization from the First World. Study Case

Una mirada a la mecanización desde el primer mundo. Estudio de caso



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ABSTRACT: The work is presented in three parts. The first one presents the use of the mechanization in Germany. In this case the form is presented in which is carried out the soil preparation; planting and it harvests using a great variety equipment (tractors and agricultural machine). In the second part the use of the mechanization is exposed in the Cuban case; emphasizing in the importance of introducing in Cuba some of these technologies of wide use in the developed world. The third part it carries out a discussion of the advantages and limitations that could be kept in mind to achieve a perproductive mechanization and a high quality, which could report an increase in the production and quality of the obtained products..

Keywords: Mechanization, Germany, Cuba.

RESUMEN: El trabajo se presenta en tres partes. La primera presenta la utilización de la mecanización en Alemania. En este caso se presenta la forma en la cual se realiza la preparación de suelo; siembra y cosecha utilizando una gran variedad de equipamiento (tractores y maquinas agrícolas). En la segunda parte se expone la utilización de la mecanización en el caso cubano; enfatizando en la importancia de introducir en Cuba alguna de estas tecnologías de amplia utilización en el mundo desarrollado. La tercera parte se realiza una discusión de las ventajas y limitaciones que pudieran tenerse en cuenta para lograr una mecanización productiva y de alta calidad, la cual pudiera reportar un aumento en la producción y calidad de los productos obtenidos.

Palabras clave: Mecanización, Alemania, Cuba.

INTRODUCTION

In repeated research visits to Germany. It has been possible to verify that the development of mechanization in this country has always had the tendency to constantly surpass itself. This has resulted in an abundant and high quality agricultural production. The first thing that strikes any visitor is the great variety of machinery used as well as the adequate preparation of the land for planting, cultivation and harvesting. From the moment the visitor observes from the air when he starts the landing, a huge mosaic can be seen where the lands prepared, in preparation, in cultivation and in harvest can be observed ([Fig. 1](#)).

Earlier work by ([Martínez et al., 2022](#)) referred to animal feed preparation in Germany. Now the focus has shifted to other agricultural activities that contribute to the production of food for human consumption.

We are of the criterion that to produce food in quantity and quality it is necessary to introduce new

technologies that increase the rates of production and quality of agricultural products. In such a difficult moment as the one Cuban agriculture is going through, it would be very useful to have the possibility of reflecting and taking as a reference what Germany is doing in this field. The objective of the present work is to present some variants used in Germany that could be introduced by Cuban state and private producers depending on the decision makers of Cuban agriculture.

We are of the approach that to produce allowances in quantity and quality is needed of the introduction of new technologies that its increase the production rhythms and quality of the agricultural products. In such a difficult moment as the one that crosses the Cuban agriculture, to have the possibility to meditate and to take as reference that makes Germany in this serious field of great utility. The objective of the present work is to present some variants used in Germany that it could be introduced by Cuban state and private producers in dependence of the people that take final decision of the Cuban agriculture.

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DEVELOPMENT OF THE TOPIC

German case: In soil preparation, multi-shank moldboard plows or moldboards are widely used. Reversible ploughs of this type are also used. Soil preparation is carried out quickly and of high quality. Summer (May-August) and Autumn (September-December) are used for soil preparation, cultivation and harvesting.

In field measurements (timing), it has been possible to quantify that in plowing at a depth of 40 cm using this type of tractors and plows, they are capable of plowing a strip of 6 m soil wide and 300 m long in 2 minutes. According to [Jrobostov \(1977\)](#), it is known that the productivity of an agricultural set (union of a tractor + an agricultural machine) is a function of the following parameters: working width, working speed, time utilization coefficient and kinematics of movement of the set. There are expressions to calculate the productivity of work in function of: working hours, working shifts, operating time, clean time, seasonal, etc. In these cases the movement within the set in the field (in the work that develops), also plays an important role, since with this it is sought to maximize the time utilization. Here it is very common to use the splitting movement method, although when the reversible plow is used in the plowing, it is easier and faster to move it in the turning strip, which is usually 3 m wide and this method is not needed, although due to the diversity of the shape of the agricultural plots here, it is clear that the classic movement methods should also be used. Here, in most of the plots this turning strip is broken, but transversally to the main furrows and is the first to be harvested. The quality of the soil preparation is excellent, leaving the soil perfectly soft to receive the seeds. From this it can be concluded that: the productivity of these sets is extremely high, compared to the Cuban case. The typification of the fields in a general way does not exist, since here any angle of the land that can be used for sowing is taken advantage of. Of course, the specific traditional producers of some crops: potato, vegetables, sunflower or others, do have their lands typified. Another interesting aspect is that there are no owners with large extensions of land, the common are extensions of land that do not exceed 50 ha (3, 7 Cab). It should be taken into account that the soil types investigated here are light and the tractors used are of medium and high power. The use of mechanization makes it possible to carry out all the work with a minimum of workers and time, and the producers have all the necessary supplies and work as a small family business (2 or 3 people). Other authors such as: [Ortiz-Cañavate et al. \(1989\)](#); [Gil \(1995\)](#); [Rodrigo-Arias & Fernández \(2001\)](#); [Alvarado \(2004\)](#); [IIMA-Cuba \(2007\)](#); [Martínez & Cruz \(2018\)](#) and [González \(1993\)](#) have touched the subject of the exploitation of tractors and agricultural machines in

order to obtain the maximum agricultural yields in the work of these sets. In their respective researches, they refer to the fundamental work parameters known to achieve a correct exploitation of agricultural units.

The following figures illustrate the German case. See [Fig.1.....10](#).

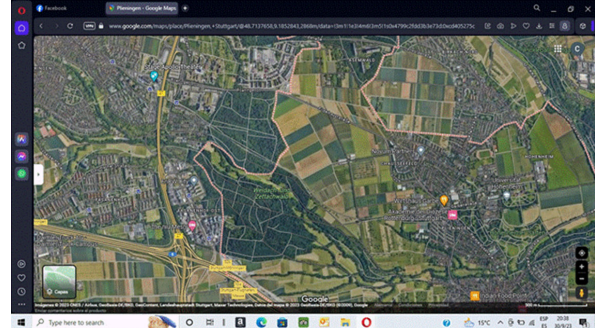


FIGURE 1. Plieningen. Stuttgart. Aerial view.

Source: Author's file.



FIGURE 2. Reversible moldboard plow with 4 working organs during ploughing. Source: Author's file.



FIGURE 3. Prepared and seeded soil. Note the turning strip. Source: Author's file.

Another aspect to highlight is the constant use of soil. Immediately after soil preparation, planting begins. In this case, the only thing that limits the productive process are the climatic conditions, product of the climatic variations (rain, wind, humidity,

temperature), these climatic variables can stop the process, but as soon as these conditions improve, planting continues. In this case, the factor that most affects German farmers is rainfall, since it increases soil humidity and prevents the use of mechanization. After planting, once the vegetative cycle of the crop is completed, harvesting begins. Once again, the introduction of medium and large combine harvesters together with the transport systems are put into action. It is common for the transporters to move in parallel with the harvesters or to wait for the harvester outside the turning belt if they are of a big tonnage in order to protect the soil from compaction. The harvester then transfers the harvested product to the conveyors. It should be noted that the well-known Cuban guardrails are paved here and the fields have underground irrigation systems surrounding the plots. It is only necessary to place the water intakes to the respective hydrants and in this way the irrigation is guaranteed. Once the harvest is finished, the crop residues are shredded and incorporated into the soil as organic matter. Depending on the organic matter and nutrient content of the soil. When the soil requires it, the soil is left to rest or is prepared again for new crops. It is also common to use animal excreta (vaccines or swine) previously treated for incorporation into the soil. Generally from biogas plants. These effluents are distributed in solid or liquid form, for which organic fertilizer distributors of the centrifugal or in-line type are used. In the following [figures 5...10](#), some of the types of tractors and machines used here to accomplish all these tasks are presented.

Another no less important detail is the final destination of the production. German producers market their production with large processing and marketing companies, which operate within the European Economic Community (EU), but they also have the option of marketing on a small scale, as long as they comply with the rules of the market. What does this mean? They cannot alter the prices of their products, they can only compete with the big companies on the basis of the freshness and quality of their agricultural production.

Cuban case: according to the Anuario Estadística de Cuba, [ONEI \(2021\)](#) the cultivated agricultural area was 1092.4 Mha (thousands of hectares) in the state sector and 1018.9 Mha (thousands of hectares) in the private sector, however; the main crops with a high degree of mechanization are: rice and sugar cane, these two crops are mostly under the management of state enterprises, being the same not very effective from the economic point of view. On the other hand, the participation of private producers in Cuban agriculture is increasing every day, reaching high volumes of food production, in spite of the obsolescence of tractors and machinery, the lack of petroleum, lubricants, seeds, pesticides, fertilizers and international financing to solve this situation; In



FIGURE 4. Soil with vegetables planted. Source: Author's file.



FIGURE 5. In-line seeder in seeding operations. Source: Author's file.



FIGURE 6. Cabbage seeder maneuvering on the turning strip. Source: Author's file.



FIGURE 7. Combine harvester transferring its production to the means of transport. Note that the harvester is placed on top of the paved road. Source: Author's file.

addition to the economic coercion measures imposed by the US government on Cuba in the last 8 years, for this reason, the situation of Cuban agriculture has presented a deplorable situation in the last two years, both in the state and private sectors. In this sense, the sharp drop in agricultural production has brought as a consequence an excessive rise in the prices of basic foodstuffs of agricultural origin and a high inflation in general in the country.

In this scenario, there are external and internal factors that affect this situation. The external factors are widely known and very little of them can be corrected, since they depend on foreign interests that are very complex to solve; however, the internal factors, in our opinion, could be corrected. Cuban agricultural producers do not have enough equipment and supplies to develop quality and quantity agriculture. In this sense, it would be very important to provide them with bank credits that would make possible their updating in this sense. Another important factor is to promote the commercialization of their production at local, territorial, national and international levels, but on the basis of the implementation of affordable prices for national consumers (set by the Ministry of Finance and Credit at the national level). This would provoke a competition among producers for the quality and quantity of their productions. The main motivation, in our opinion, would be the profits they could obtain and the updating of their means of production. Another important element would be to bring closer to their places of residence (production) all the facilities and advantages of the big urban centers. In this way, the exodus from the countryside to the city in search of better life options would be reduced and stability would be achieved in families engaged in agricultural activities. Finally, according to [Herrera \(2023\)](#), the road map to control inflation and reverse it includes, among other things, increasing the supply of both domestically produced and imported food, preferably the former. And that is not achieved with exhortations, it is with will, financial and human resources, and of course with what science says to be productive in the short term. I don't know why it is not understood and acted upon that food is a primary need with a great impact on life, and also on politics, when it is not guaranteed. There is no more important mission. Another important element to highlight is the need to train private producers in the advantages of accessing national bank loans, to facilitate them both nationally and internationally to be able to buy the necessary inputs in wholesale stores and finally to be able to market their production surpluses nationally and internationally.

DISCUSSION

It has been observed that the comparison between both mechanization systems have common and



FIGURE 8. Liquid organic fertilizer spreader (effluent). Source: Author's file.



FIGURE 9. Field after application of biodigester effluent. Source: Author's file.



FIGURE 10. Agricultural products for sale, labeled with their price. Source: Author's file.

divergent points. The common points in our opinion are related to the importance of a good soil preparation, as well as the whole procedure that follows: planting, cultivation, harvesting, processing and marketing. However, the divergences are in the necessary infrastructure to introduce these technologies in the Cuban case. In our opinion, it is

not possible to achieve agricultural production of quality and quantity without modernizing or updating the means of production of Cuban producers. In this sense, it is necessary to invest in order to obtain appropriate results. Perhaps one way could be the use of small family enterprises that demonstrate their potentiality to produce and commercialize their productions under the supervision of the state (reference producers), which could be a driving force for other producers and at the same time that these producers could be able to commercialize their productions without violating the established price policy.

If the productive forces were released in this direction, perhaps they could bring important dividends to the country by increasing the production and quality of agricultural production, reducing imports of human food and raising the standard of living of society in general.

CONCLUSIONS

This study confirms that the intensive use of mechanization in Germany for agricultural activities is conducive to high quality agricultural production, on the other hand, it is a stable source of work for agricultural workers and at the same time allows them to obtain income for the maintenance of their high standard of living. It has been seen that in order to achieve the above, an infrastructure to support this system is needed, which must be achieved beforehand. So, taking this country as a **study case**, the most important thing would be to try to introduce in Cuba these successful, mature and sufficiently viable examples. In the Cuban case, the first thing that should be banished from the thinking of our decision-makers is the belief that it is possible to obtain important productive results without the presence of generalized agricultural mechanization. Secondly, to finish defining that an enterprise without positive economic results has no basis to exist, be it state or private, and the third thing that is obvious is that if the agricultural worker is not motivated to obtain a high quality agricultural production that can pay his initial expenses and provide him with profits and welfare for him and his family, the above will always be very difficult or almost impossible to achieve.

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REFERENCES

- ALVARADO, C., A.: *Maquinaria y mecanización agrícola*, Inst. Universidad Estatal a distancia, José, Costa Rica, 570 p., 2004.
- GIL, E.: *Maquinaria agrícola. Tractor, preparación de suelo y siembra*, Inst. Escola Superior D'Agricultura de Barcelona, Universitat Politecnica de Catalunya, Catalunya. España, 49 p., 1995.
- GONZÁLEZ, V.R.: *Explotación del parque de maquinaria*, Ed. Félix Varela, ENPES ed., La Habana, Cuba, 1993.
- HERRERA, H.C.: *La ONEI publica el IPC mayo 2023. Sigue al alza la inflación, [en línea], 2023, Disponible en: <https://cubayeconomia.blogspot.com/search/label/Humberto%20Herrera%20Carles>, [Consulta: 21 de septiembre de 2023].*
- IIMA-CUBA: *Tecnologías para las producciones agrícolas en Cuba*, Inst. Instituto de Investigaciones de Mecanización Agropecuaria (IIMA), La Habana, Cuba, 148 p., 2007.
- JROBOSTOV, S.N.: *Explotación del parque de tractores y maquinas*, Ed. Mir, Moscú, URSS, 552 p., 1977.
- MARTÍNEZ, C.; CRUZ, M.: *Fundamentos de mecanización agropecuaria*, Ed. Félix Varela, La Habana, Cuba, 215 p., 2018, ISBN: 978-959-07-2327-8.
- MARTÍNEZ, C.; OECHSNER, H.; GONZÁLEZ, A.: “Preparación de alimento animal en Alemania”, *Revista Ciencias Técnicas Agropecuarias*, 31(2), 2022, ISSN: 2071-0054.
- ONEI: *Anuario Estadístico de Cuba. 2021. Capítulo 9. Agricultura, Ganadería, Silvicultura y Pesca*, Inst. Oficina Nacional de Estadística e Información, La Habana, Cuba, 482 p., 2021.
- ORTIZ-CAÑAVATE, J.; RUIZ-ALTISENT, M.; HERNANZ, J.L.: *Las maquinas agrícolas y su aplicación*, Ed. Ediciones Mundi-Prensa, Madrid, España, 488 p., 1989.
- RODRIGO-ARIAS, I.; FERNÁNDEZ, M.A.: *Maquinaria agrícola. Guía de apoyo a la docencia*, Ed. Universidad Católica de Temuco, Temuco, 83 p., 2001.

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