



## **Training and Demonstration of Different Agricultural Machinery in Western Zone of Tigray, Ethiopia**

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### **Author's contribution**

*The sole author designed, analyzed and interpreted and prepared the manuscript.*

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### **ABSTRACT**

Training, on- farm demonstration and testing of different agricultural machinery, was conducted in the Western zone of Tigray, Ethiopia with the objective of creating awareness, providing an opportunity for trainees to familiarize with, learn to operate, use and maintain different agricultural machinery. The trainers were highly experienced and they are very familiar with different agricultural machinery two from Ethiopia and one is from Kenya. 84 trainees were participated in the training on the given time and captured enough knowledge and skill about different agricultural machinery how to operate, use and maintain different agricultural machinery. Small scale farmers and investors want to introduce row planters, harvesters but they lack skill, knowledge about the machinery and finance. The training was given to develop their skill, knowledge and to introduce agricultural machinery to increase their production of different crops from time to time. The theoretical and practical trained participants of Different Small scale farmers and investors are evaluating the field performance of row planted different crops at different stages. After careful evaluation and observation, they will decide to select the best row planter and other agricultural machinery to the area.

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## 1. INTRODUCTION

Mechanization has had a major impact on the demand and supply for farm labor; the profitability of farming; and the change in the rural landscape, including rural communities. The introduction of new technology usually results in losers and gainers. For example, the introduction of the mechanical tomato harvester in California created considerable controversy, primarily due to farm workers not being compensated for lost wages [1].

Odigboh [2] Defined agricultural mechanization as the use of any machine to accomplish a task or operation involved in agricultural production. [3] Expressed farm mechanization as the application of engineering principles and technology in agricultural production, storage and processing; where these activities and applications are not limited within the boundaries of the farm units only. [4] Reported agricultural mechanization as an engineering system that requires not only advances in machine development and applications but also close cooperation of many sections. In recognition of this fact, certain Environmental, agricultural, social and economic conditions must be ascertained to favor investment in mechanization technologies and their sustainable use.

The study indicates that farm mechanization is an adjunct to more fundamental influences on agricultural production and productivity in the ECA region, rather than a means to directly increase output. Across all ECA countries, regression analysis shows that the impact of mechanization on productivity is modest. A 10% increase in tractor investment is associated with a 2% increase in agriculture value-added/hectare of arable land (statistically significant at 5%). This suggests that mechanization enhances the impact of more fundamental changes such as technological innovation, changes in factor costs and changes in institutions such as land use rights. Hence, farm mechanization will have the strongest impact on agricultural productivity where reform is advanced and farm wages are high, as in the more advanced accession countries. There is no evidence that mechanization compromises rural poverty reduction in low-income ECA countries, by driving down rural wages or reducing rural employment. Machinery does eventually substitute for labour, but only in more

advanced countries where rural poverty is low. At the same time, there is no evidence that mechanization contributes to poverty reduction – at least with existing types of farm machinery. Low-income farmers seek to mechanize their operations nevertheless, as evidenced by the increased use of horses among small-scale farmers. The growing use of farm machinery in Asian countries also shows that there are x low-cost alternatives to animal power and that the benefits of mechanization can be extended to low-income farmers. This machinery enhances the capacity to mechanize farm operations at a much lower cost of capital, both in absolute terms and relative to farm labour. In the ECA region, improved access to such machinery could facilitate increased mechanization in countries with cautious approach to reform, especially where labour-intensive production systems and small-scale farms predominate. The study also shows that the ability of small-scale farmers to invest in farm machinery is constrained by limited access to credit, leasing and insurance [5].

Mechanization is a crucial input for agricultural crop production and one that historically has been neglected in the context of developing countries. Factors that reduce the availability of farm power compromise the ability to cultivate sufficient land and have long been recognized as a source of poverty, especially in sub-Saharan Africa. Increasing the power supply to agriculture means that more tasks can be completed at the right time and greater areas can be farmed to produce greater quantities of crops while conserving natural resources. Applying new technologies that are environmentally friendly enables farmers to produce crops more efficiently by using less power. Sustainable agricultural mechanization can also contribute significantly to the development of value chains and food systems as it has the potential to render postharvest, processing and marketing activities and functions more efficient, effective and environmentally friendly.

Increasing levels of mechanization do not necessarily mean big investments in tractors and other machinery. Farmers need to choose the most appropriate power source for any operation depending on the work to be done and on who is performing it. The level of mechanization should meet their needs effectively and efficiently. Women play an important role in many farming

based communities, and in some countries, up to 80 percent of the total farm labour comes from women. This implies that power sources (human, animal or motor- based) need to be adapted to such necessities from an ergonomic, social, cultural and economic point of view. The reduction of drudgery is a key element of sustainable mechanization and contributes to reducing women's hard workload by taking into consideration technologies apt to their needs and improving their access to appropriate forms of farm power. Sustainable mechanization can increase land productivity by facilitating timeliness and quality of cultivation, support opportunities that relieve the burden of labour shortages and enable households to withstand shocks better, decrease the environmental footprint of agriculture when combined with adequate conservation agriculture practices, and reduce poverty and achieve food security while improving people's livelihoods [6].

Mechanised agriculture is the process of using agricultural machinery to mechanise the work of agriculture, greatly increasing farm worker productivity. In modern times, powered machinery has replaced many farm jobs formerly carried out by manual labour or by working animals such as oxen, horses and mules. The entire history of agriculture contains many examples of the use of tools, such as the hoe and the plough. But the on-going integration of machines since the Industrial Revolution has allowed farming to become much less labour-intensive. Current mechanised agriculture includes the use of tractors, trucks, combine harvesters, countless types of farm implements, aeroplanes and helicopters (for aerial application), and other vehicles. Precision agriculture even uses computers in conjunction with satellite imagery and satellite navigation (GPS guidance) to increase yields. Mechanisation was one of the large factors responsible for urbanisation and industrial economies. Besides improving production efficiency, mechanisation encourages large scale production and sometimes can improve the quality of farm produce. On the other hand, it can displace unskilled farm labour and can cause environmental degradation (such as pollution, deforestation, and soil erosion), especially if it is applied short-sightedly rather than holistically [7].

Agricultural machinery is machinery used in farming or other agriculture. There are many types of such equipment, from hand tools and

power tools to tractors and the countless kinds of farm implements that they tow or operate. Diverse arrays of equipment are used in both organic and nonorganic farming. Especially since the advent of mechanised agriculture, agricultural machinery is an indispensable part of how the world is fed [8].

Western zone of Tigray is classified under three agro –ecologies; low land, mid land and high land. The low land is suitable for the production of many lowland crops; sesame, sorghum, pearl millet, rice, soybean, mung bean, haricot bean, sunflower, safflower, cotton, okra, tomato, onion, jearjir, Molokai, tropical fruits. In the mid land and high land agro-ecology different crops are growing; Teff, wheat, barley, wheat, faba bean, lentil, linseed, highland safflower etc. The population size in the area is increasing at alarming rate whereas the crop production is very low as compared with other countries. This low production is due to lack of introducing and using agricultural farm mechanization, lack modern agriculture. Investors and farmers have no interest to introduce the agricultural mechanization and modern agriculture as well as to increase the agricultural production because of lack of awareness on the agricultural mechanization and modern agriculture in the area. The training, on farm demonstration and agricultural farm machinery evaluation is designed creating awareness, providing an opportunity for trainees to familiarize with, learn to operate, use and maintain different agricultural machinery in western zone of Tigray [9].

### **1.1 History of Agricultural Mechanization in North Western and Western Zone of Tigray, Ethiopia**

Even though north western and western zone of Tigray has large flatland, many rivers, suitable farm lands for investment and agricultural production there is no agricultural mechanization introduced before. No agricultural mechanization such as row planters, cultivators, harvesters, land leveling machines, seed cleaning machines, threshers etc. were practiced in the area. Small scale farmers ploughing by oxen, investors by tractors but not row planters, harvesters, threshers. As a result the productivity of the area is very low as compared to other countries using modern agriculture mechanization.

## 2. MATERIALS AND METHODS

The training was given in 2017 of season for different agricultural machinery by two Ethiopian and Kenyan expertise. 84 participants from different areas were included in the training. Three different hoper precision row planters, land leveling machine, animal feed grinder, and Metal silo were brought from Brazil, Locally fabricated seed cleaning machines and other agricultural machinery; cultivators, sprayers, disc harrow, disc plough, different types of tractors, were demonstrated in the training. Theoretical concept of agricultural machinery as well as practical training was given during the training; how to operate, different parts of the machinery, how to lubricate etc. The training on agricultural machinery was given for consecutive 10 days both theoretical and practical, on farm demonstration, field observation and evaluation. The trainers were highly experienced and they are very familiar with different agricultural machinery two from Ethiopia and one from Kenya.

### 2.1 Major Challenges in Agricultural Mechanization in Western Zone of Tigray

- Lack of awareness and using mechanization both small scale farmers and investors
- Lack of agricultural machinery maintenance and spare parts
- Lack farmers skill and knowledge
- Financial problem
- No suitable agricultural machinery introduced to the area
- Limited government attention and mechanization policy

### 2.2 Opportunity for Agricultural Mechanization in Western Zone of Tigray

- Large suitable for investment
- Many crops can grow in this area sesame, sorghum, cotton, Mung bean, pearl millet, soybean
- Low land vegetables and tropical fruits
- Annually flowing rivers, Tekeze, Mokoza, Bahre selam, Kaza and others
- Near to Sudan, Eritrea and this is suitable for export products
- Suitable agro ecology for production of industrial and other crops

- Accessible roads and other infrastructures. (Personal observation and mobile communication, 2016)

### 2.3 Advantage of Using Row Planting over Broad Casting

- Keeps uniform plant density and plant population
- Enables easy weed management
- Suitable for spraying insecticides, herbicide, fungicide
- Suitable for fertilizer application
- Suitable for harvesting
- Allows uniform air circulation within the field

## 3. RESULTS AND DISCUSSION

The trainers grasped different parts of agricultural machineries and farm equipment's such as Row planters, BBM (Broad Bed Management), different Tractors, Chopper, metal sile, Disc plough, disc harrow, cultivator, sesame harvesters, insecticide sprayer, seed cleaners, sesame during the training in 2017 in western zone of Tigray, Ethiopia .How to operate, how to fix different agricultural machinery, how to maintain, the advantage of Agricultural mechanization in commercial crop production, pest management, labour cost minimization, timely ploughing, harvesting, threshing etc. After theoretical training different row planters were demonstrated at irrigation research field for sesame (0.5ha), sorghum (0.5ha), Mung bean (0.5ha) and soya bean (0.5ha) according to the recommended spacing of each crop between rows and plants. The trainees finally evaluate different machineries weather they are suitable for their area or not. In developed country the economy is boosted through using mechanization similarly we want introduce mechanization to our area to increase our productivity through mechanization. Theoretical and practical trained participants of Different Small scale farmers and investors are evaluating the field performance of row planted different crops at different stages. After careful evaluation and observation they will decide to select the best row planter and other agricultural machinery to the area.

Farmers and investors are evaluating the performance, efficiency and advantage of row planters in different crop growth stages under irrigation and will continue under rain fed

condition in the coming season. As we can see in plate from 16 to 20 the crops were planted by multi crop row planter under irrigation after consecutive 10 days training. Different small scale farmers and investors were visited and

evaluated under field condition. After careful evaluation and observation the performance and efficiency of the machinery they will decide to introduce those machineries from different country.



**Plate 1. Row planter field demonstration**





**Plate 2. Theoretical and practical training**



**Plate 3. Multi crop seed cleaning machine**



**Plate 4. Demonstration of locally fabricated multi crop seed cleaner**



Plate 5. Drilling row planter



Plate 6. Different type Precision row planter





**BBM (Broad Bed Management)  
and disc harrow**

**Disc plough and disc harrow**

**Plate 7. Different agricultural machinery**



**Plate 8. The participants learnt all the internal parts of the row planters as well as how to operate**





**Plate 9. Land ploughing and leveling**



**Plate 10. BBM (Broad bed management)**



**Plate 11. Metal silo fixed by the participants during the training**



**Plate 12. Mungbean threshing using multi crop thresher**



**Plate 13. Rotary cutter (Crop residue and weeds cleaner)**





**Plate 14. Insecticide sprayer**



**Plate 15. Animal feed grinder**



**Row planted sorghum, Sesame, Soybean and Mungbean after the training**



**Plate 16. Sesame**



**Plate 17. Sorghum**



**Plate 18. Mung bean**







**Plate 19. Soybean**



**Plate 20. Family photo of the participants**



#### 4. SUMMARY AND CONCLUSION

The training and on-farm demonstration for different agricultural machinery: Row planters, BBM (Broad Bed Management), different Tractors, Chopper, Disc plough, disc harrow, cultivator, sesame harvesters, insecticide sprayer, sesame seed cleaners, sesame harvesters were conducted during of season in 2017 in western zone of Tigray, Ethiopia . The row planters were demonstrated at irrigation research field for different crops such as sesame (0.5ha), sorghum (0.5ha), Mung bean (0.5ha) and soya bean (0.5ha) according to the recommended spacing of each crop between rows and plants in the area. The training on agricultural machinery was given for consecutive 10 days both theoretical and practical, on-farm demonstration, field observation and evaluation. The trainers were highly experienced and they are very familiar with different agricultural machinery two from Ethiopia and one from Kenya. 84 trainees were participated in the training on the given time and captured enough knowledge about how to operate, maintenance. The trainees finally evaluate different machineries weather they are suitable for their area or not. In developed country the economy is boosted through using mechanization similarly we want introduce mechanization to our area to increase our productivity through mechanization. Theoretical and practical trained participants of Different Small scale farmers and investors are evaluating the field performance of row planted different crops at different stages. After careful evaluation and observation they will decide to select the best row planter and other agricultural machinery to the area.

#### CONSENT

As per international standard or university standard, written participants' consent has been collected and preserved by the authors.

#### COMPETING INTERESTS

Author has declared that no competing interests exist.

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