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Revolutionizing the Harvest: A Technical Review of the Meicott PT120 Cotton Monitoring System and Its Impact on Agricultural Traceability

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Abstract. This paper gives a technical review of Meicott PT120, which is a retrofittable system to cotton harvesting machines for real-time yield detection, moisture monitoring and data logging. The main problem addressed is the lack of integrated digital weighing and traceability systems in a significant proportion of existing cotton harvesting equipment, leading to potential value loss and inefficiencies, especially in accurately measuring yield and monitoring the quality of the cotton harvested. This review is based on academic literature on smart farming [1; 2; 3] and a detailed technical test report from the SÖKE Agricultural Training Center [4]. The method consisted in studying the components of the sys-tem, such as the control unit, hydraulic pressure and optical sensors, moisture unit, GNSS module, and the results of laboratory and field tests [4]. The results show a high accuracy with an error between 0.1% and 0.9% when compared with certified scales [4]. The discussion points to significant advantages of the system including improved traceability, data driven decisions for farmers, contractors and industrialists and the availability of reliable parcel level data for governmental agricultural policy and distribution of support. The paper finds that the Meicott PT120 technology is a feasible and efficient technology for modernization of the cotton value chain in line with the larger vision of precision agriculture.

Keywords: Meicott, Digital Farming, Yield Monitoring, Cotton Harvesting

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1 Introduction

Meeting the food needs of the ever-increasing world population is one of the most fundamental challenges of agricultural production [3]. The latest population projections show that the world population will reach 9.8 billion in 2050 and 11.2 billion in 2100, resulting in an increase in the demand for food. This challenge brings with it the responsibility not only to ensure today's food supply security but also to guarantee a world for future generations to live in [1]. At this point, the principle of sustainability in agriculture comes into play, and developing technological systems is at the center of this process [2]. Innovations such as precision agriculture practices, the Internet of Things (IoT), sensor technologies, and data analytics bring to life the philosophy of 'more with less' by enabling the minimal and most efficient use of limited resources like water, soil, and fertilizer [1; 3]. Therefore, the integration of these systems in agricultural production is not only an increase of effi-ciency, but a strategic imperative that safeguards the security of food supply and the rights of future generations, protecting the ecological balance of our planet [2; 3].

The agricultural industry is experiencing a significant transformation driven by the use of cutting-edge technologies to meet the demand of a growing global population and to promote environmental sustainability. Also known as “precision farming” or “smart agriculture”, this evolution is based on innovations such as the Internet of Things (IoT), advanced sensor networks and data analysis to improve farming practices [2; 3]. Such technologies (e.g., real-time monitoring [1]) provide real-time data for farmers to make data-driven decisions. It is more resource efficient with better yields and lower environmental footprint [1; 2; 3]. Real time monitoring of crop yield is an important technology for agricultural intelligence. The field yield distribution helps farmers to make quantitative decisions on planting, fertilization, spraying, variable inputs and position implementation plans for the next season agricultural production management [5; 6].

Harvesting is the most important final step in converting cotton from production to value creation. Now success is translated directly into increased profits and failures into losses along the whole value-added chain. One of the major problems is that most of the cotton harvesters being used today do not have systems for real-time and accurate measurement of yield and monitoring of the harvest. Addressing this gap, the Meicott PT120 Cotton Harvest Yield Detection and Moisture Monitoring System has been developed as a retrofittable solution. This paper aims to provide a technical overview of the Meicott PT120 system, its operational principles, and its performance based on the official test report from the SÖKE Agricultural Production Enterprise, Agricultural Extension, and Inservice Training Center Directorate [4].

2 Materials and Methods

The evaluation of the system is based on the technical specifications and testing protocols detailed in the official SÖKE test report [4]. All the instruments and sensors are shown in Fig. 1.

Fig. 1. Meicott Digital Monitoring sensors and units.

The Meicott PT120 System Components

Control Unit: Housed in the operator's cabin, this unit is the system's brain, featuring a screen and software for data input and display. It logs machine details, operator information, and farm/parcel data, while displaying real-time yield, tare weight, humidity, time, and location via its integrated GNSS (Global Navigation Satellite System) and SIM card (Subscriber Identity Module) functionality.

Yield Detection Unit: This unit calculates cotton weight using two sensor types. A Gefran brand pressure sensor measures changes in the hydraulic pressure of the basket's lifting/tipping mechanism. Simultaneously, a Leuze brand optical sensor with two laser eyes performs approximately 80 readings across a reflector to ensure precision. The system is compatible with both hydraulic lift and tipping basket cotton pickers.

Moisture Monitoring Unit: The HM-200 model unit is mounted externally to measure the relative humidity of the air. It is programmed to issue a warning if humidity exceeds a preset threshold (e.g., 70%), preventing the harvest of wet cotton that can compromise quality.

Global Navigation Satellite System (GNSS) Unit: This unit provides real-time location data, linking all yield and moisture information to specific plots of land (identified by island/parcel numbers) to enable precise spatial analysis.

2.1 Testing Methodology

The system's accuracy was evaluated through a two-phase testing protocol as described in the report

Laboratory Tests: These tests were conducted in a controlled environment. Fixed weights of 200, 300, 400, 500, 600, 700, and 800 kg were loaded into the baskets of two different types of cotton pickers (a Case IH with a hydraulic lift and a John Deere with a tipping basket). The system's measurements were then compared against these known weights to determine its baseline accuracy.

Field Tests: Real-world performance was assessed in two separate locations: Söke and Germencik. During active cotton harvesting, the weight of each full basket as measured by the Meicott system was recorded. The cotton was then transferred to a trailer and weighed on a separate, certified, and licensed weighbridge. These two values were compared to determine the system's accuracy under operational conditions. The device has also been tested in the GANJA district in the Prime Cotton Farm field.

3 Results and Discussion

3.1 System Performance and Accuracy

All performance data is derived from the field and laboratory trials detailed in the official report [4]. The Meicott PT120 system demonstrated a high degree of accuracy in both testing phases.

In the laboratory tests, the system measured known fixed weights with a confirmed error margin of just ±0.1%.

In the field tests, the system maintained high accuracy. In one trial, the Meicott system recorded a total weight of 7,390 kg, while the certified weighbridge recorded 7,400 kg, a deviation of only 0.1%. In a second trial, the system recorded 6,820 kg against the weighbridge's 6,760 kg, an error margin of 0.9%. The average relative humidity during these harvests was recorded at 26% and 28%, respectively, confirming the system's ability to log environmental conditions alongside yield data.

3.2 System Performance Test in GanJa District

The yield monitoring has been validated in the GANJA district in the field of the PRIME COTTON firm in AZERBAIJAN. The cotton harvester was adjusted with Meicott 120 yield monitoring (Fig. 2).

Fig. 2. Meicott monitor in the cabin

The cotton harvest at Prime Cotton (Fig. 3) was recorded at 1.470 kg, subsequently verified using a weighbridge to be 1.480 kg, as illustrated in Fig. 4.

Fig. 3. Cotton harvestin of Prime Cotton Field.

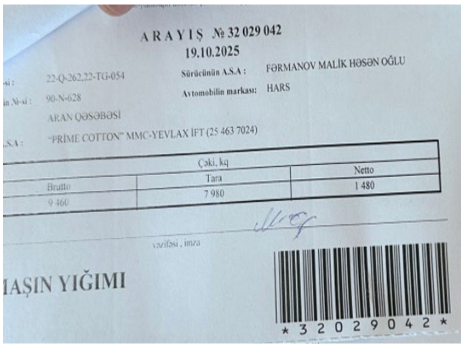

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Fig. 4. Weighbridge results of cotton harvested from the field of Prime Cotton.

3.3 Traceability and Stakeholder Benefits

The proven accuracy of the system and its data logging capabilities [4] offer significant advantages along the cotton value chain, one major advantage being traceability. The system adds value and ensures data integrity at the first step of the supply chain by offering a verifiable digital record.

To the Farmer, the system allows the harvest to be monitored in real time, with instant results by way of phone messages and printouts. Farmers can compare Meicott records to weighbridge slips and record that their produce was harvested under the right humidity conditions, protecting their income and maintaining quality.

Cotton Picking Machine Contractors, the system provides real time monitoring of machine and operator performance to help you improve work efficiency through data driven decisions.

For the Gin Operators, Merchants and Industrialists: They are guaranteed a secure, documented record of the location, time and circumstances of the harvesting of the product. This ensures quality standards of the bought raw material, particularly levels of humidity of the harvest.

Ministry of Agriculture, System is an effective tool for policy and supervision' It enables validation of harvesting under proper conditions nationally and provides immediate parcel level data on yield, date, operator and humidity. This helps with equitable distribution of subsidies, quick and cost-effective generation of national statistics and creation of a reliable database for effective policy making.

4 Conclusion

The technical evaluation shows the Meicott PT120 Yield Detection and Moisture Monitoring System to be a highly accurate and reliable tool for modern cotton harvesting. [4] The SÖKE test report states that the system is technically correct and suitable for agricultural use. It directly responds to the vital need for traceability and efficiency in the cotton value chain by delivering accurate, real-time, and geo-referenced data. The implementation of such technologies is critical to enable stakeholders, from farmers to policy makers, to have the data to optimize production, ensure quality, and advance the goals of precision agriculture.

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