ISSN: 3062-3235
I-CRAFT AGRICULTURAL and FOOD TECHNOLOGIES

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 provides a technical review of the Meicott PT120, a retrofittable system designed for cotton harvesting machines to provide real-time yield detection, moisture monitoring, and data logging. The primary challenge addressed is the lack of integrated digital weighing and traceability systems in much of the existing cotton harvesting machinery, which leads to potential value loss and inefficiencies, particularly in accurately measuring yield and tracking the quality of harvested cotton. This review synthesizes information from academic literature on smart farming [1; 2; 3] and a detailed technical test report from the SÖKE Agricultural Training Center [4]. The methodology involved analyzing the system's components—including its control unit, hydraulic pressure and optical sensors, moisture unit, and GNSS module—and the results of laboratory and field tests [4]. The findings indicate a high degree of accuracy, with an error margin between 0.1% and 0.9% when compared to certified scales [4]. The discussion highlights the system's significant benefits, including enhanced traceability, data-driven decision-making for farmers, contractors, and industrialists, and the provision of reliable, parcel-level data for governmental agricultural policy and support distribution. The paper concludes that the Meicott PT120 is a viable and effective technology for modernizing the cotton value chain, aligning with the broader goals of precision agriculture.

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

Article Info: Research Article
Received:
Accepted:
Doi Number:

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 into agricultural production is not just an increase in efficiency but a strategic imperative that secures food supply security and the rights of future generations by protecting our planet's ecological balance [2; 3].

The agricultural sector is undergoing a profound transformation, driven by the integration of advanced technologies to meet the demands of a growing global population and promote environmental sustainability. This evolution, often termed "smart agriculture" or "precision farming," leverages innovations like the Internet of Things (IoT), sophisticated sensor networks, and data analytics to optimize farming practices [2; 3]. By providing real-time data, such as real-time monitoring, these technologies empower farmers to make informed, data-driven decisions [1]. The result is a more efficient use of resources, increased yields, and a smaller environmental footprint [1; 2; 3]. Real-time monitoring of crop yields is a key technology for agricultural intelligence. Farmers can make quantitative decisions on planting, fertilization, spraying, variable inputs, and position implementation plans for the next season's agricultural production management based on the distribution of yield in the field [5; 6].

In the cotton industry, the harvest is the critical final stage where production is converted into value. Success at this stage directly increases profits, while failures lead to losses that ripple through the entire value-added chain. A primary challenge is that many existing cotton harvesting machines lack integrated systems for accurately measuring yields and monitoring harvest conditions in real-time. 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.

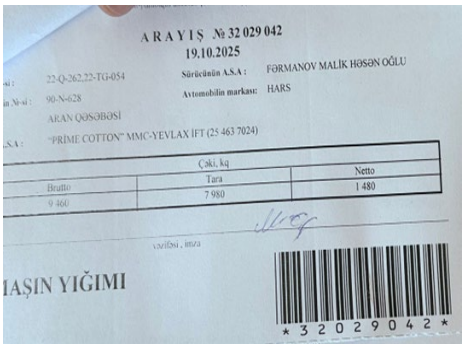
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Fig. 4. Weighbridge results of cotton harvested from the field of Prime Cotton.

3.3 Traceability and Stakeholder Benefits

The demonstrated accuracy and data logging capabilities of the system [4] translate into significant benefits across the entire cotton value chain, with traceability as a core advantage. By providing a verifiable digital record at the very first link of the supply chain, the system protects value and ensures data integrity.

For the Farmer: The system provides moment-to-moment harvest monitoring, with immediate results available via phone messages and printouts. Farmers can cross-check Meicott records with weighbridge slips and document that their product was harvested under appropriate humidity conditions, thus protecting their income and ensuring quality.

For Cotton Picking Machinery Contractors: The system enables instant monitoring of machine and operator performance, allowing for data-driven improvements in work efficiency.

For Gin Operators, Merchants, and Industrialists: They receive a secure, documented record of where, when, and under what conditions the product was harvested. This ensures the purchased raw material meets quality standards, particularly regarding harvest humidity levels.

For the Ministry of Agriculture: The system provides a powerful tool for policy and oversight. It allows for the verification of harvesting under proper conditions on a national scale and provides instant, parcel-level data on yield, date, operator, and humidity. This enables the fair distribution of subsidies, the rapid and low-cost generation of national production statistics, and the creation of a reliable database for effective policymaking.

4 Conclusion

The technical evaluation confirms that the Meicott PT120 Yield Detection and Moisture Monitoring System is a highly accurate and reliable tool for modern cotton harvesting. The SÖKE test report concludes that the system is technically sound and suitable for agricultural use [4]. By providing precise, real-time, and geo-referenced data, it directly addresses the critical need for traceability and efficiency in the cotton value chain. The implementation of such technologies is vital for empowering stakeholders, from farmers to policymakers, with the data needed to optimize production, ensure quality, and advance the goals of precision agriculture.

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