cells are cultivated under conditions of reduced temperature 20-25°C. The greatest accumulation of recombinant CtxB was observed in the lysate of cells grown on a rich nutrient medium. The maximum content of CtxB in the supernatant of producer cultures was also observed on 21NB medium. With prolonged growth on M9 medium, the content of the target protein in the cultivation medium constantly increases and 48 hours after induction reaches 50 mg/liter. At the same time, the protein is stable and retains its natural pentameric structure.

Conclusion: The result of the work was the creation of a genetic system and a method for producing recombinant CtxB. It has been established that growing a culture of the producer strain on a synthetic nutrient medium M9, followed by purification of the protein from the culture liquid using metal chelate chromatography, appears to be optimal for one-step isolation of the highly purified β-subunit of cholera toxin.

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EVALUATING THE PERFORMANCE OF WHEAT DRILLS BY SEED DISTRIBUTION METRICS: CASE OF TSELOT FARM, ERITREA

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***Abstract:** This study evaluated the uniformity of plant populations in two plots by randomly positioning a 1-m^2 wire at 10 locations within each plot. Statistical analysis revealed that plot-3 had a higher overall plant population as compared with plot-2 and exhibited greater variability, indicating possible inconsistencies in planting practices. The automation or precision-guided operations is expected to improve the consistency of planting across the plots.*

***Keywords:** Agricultural mechanization, plant density, Eritrea, t-tests, Mann-Whitney U-tests.*

Introduction

Agricultural mechanization plays a crucial role in enhancing agricultural productivity and income generation, especially in economies heavily reliant on agriculture [1]. It involves using a range of tools and machinery to reduce labor, increase efficiency, and improve the timeliness of such operation as planting and harvesting. By reducing peak labor demand [2] and ensuring timely operations, mechanization boosts yields and profitability. However, effective evaluation of farm machinery operations (including precision sowing) is essential to optimize resources such as land, energy, and labor. Precision in seed placement is assessed by evaluating seed distribution uniformity and the accuracy of machinery routes to ensure precise and efficient planting practices.

The density of sprouting plants is determined by both the sowing density and the emergence rate. For a given plant density, the uniformity of plant distribution during emergence may have a considerable influence on productivity. Apart from the seed germination rate and seed viability, which may be the same for the same grade seeds, and the effect of pests or extreme local environmental conditions (excess or deficit of moisture, low temperature) the mechanism used for sowing affects the uniformity of plant population.

Real-time and post-operation evaluation of planting is fairly new in Eritrean agriculture. To improve the operational organization of wheat planting at Tselot Farm in Eritrea, it was essential to conduct a post-operation evaluation of the machinery's performance. Rainfed wheat is an essential crop in Eritrea and is mostly cultivated in the highlands, covering approximately thirty thousand hectares every year. Therefore, this study aimed to evaluate the performance of planting machinery, specifically the "Nardi Dora Air Drill," to ensure uniform population density in the wheat fields at Tselot Farm, Eritrea.

Objective: To evaluate the performance of a pneumatic seed drill by assessing the uniformity of seed distribution metrics (by counting the number of sprouting plants).

Methodology

Study location, machinery parts and operational description

The study was conducted at Tselot Farm in Asmara, Eritrea, which is located at a latitude of 15°17'6.4" N and a longitude of 38°56'59" E at an elevation of 2341 m above sea level. As part of regular wheat sowing operations, a field experiment was carried out on an area of 107 ha using a tractor-mounted Nardi Dora Air Drill owned by the Eritrean Crop and Livestock Corporation (ECLC).

The Nardi Dora Air Drill is a pneumatic seed drill that can be trailed or mounted, and it comes in four different working widths and coulter configurations: [width: coulter number = 3: 20 or 24, 4: 29 or 32, 5: 32, 36 or 40, and 6: 32, 36 or 40]. It is equipped with mechanical or optional hydraulic bout markers and PTO (or optional hydraulic) driven fan, and it has an 800-liter capacity seed hopper [3]. The 40-row seed drill is used with an inter-row spacing of approximately 15 cm and requires a power rating of 110 hp [3].

Owing to a delay in rainfall, the main tillage was postponed, resulting in a delay in pre-sowing tillage operations that could affect the sowing dates. To address this issue, planting was conducted simultaneously with pre-sowing tillage. Since there was no rainfall during the experimental period, the dry and dusty soil made it difficult for the operator to accurately follow the marker lines. To overcome this challenge, individuals were positioned along the direction of the operation to guide the operator by standing on the marked line. Consequently, the operator decided to overlap a portion of the previous pass in the subsequent pass to minimize the unsown area. However, this could potentially lead to variations in plant density and deviations from the recommended seeding rate.

Analysis

To assess the uniformity of plant distribution, a 1-m square wire was randomly placed at 20 different points within the selected plots (which were relatively free of weeds to make counting easier). The number of plants within each sampled point, captured by the square wire, was counted and the data were analyzed for uniform distribution. Descriptive statistics and statistical tests were performed to analyze the differences in plant density between the two plots.

The descriptive statistics metrics measured were the Mean, Standard Deviation, Minimum, Maximum, Skewness, and Kurtosis. The statistical tests included an independent samples t-test to determine if there was a significant difference between the means of the two datasets, a non-parametric Mann-Whitney U-test (alternative to the independent t-test) to compare the distributions of the datasets, and an individual one-sample t-test performed for each dataset to evaluate the mean significance difference from the hypothesized value.

Results and discussions

The uniformity of the distribution of the plant population is shown in Fig. 1. Plot 3 exhibited a larger area with a plant population density ranging from 154 to 253 plants/m^2. However, a higher population density was observed on one side of the plot. In contrast, the density variation in Plot 2 appeared to lack a discernible pattern.

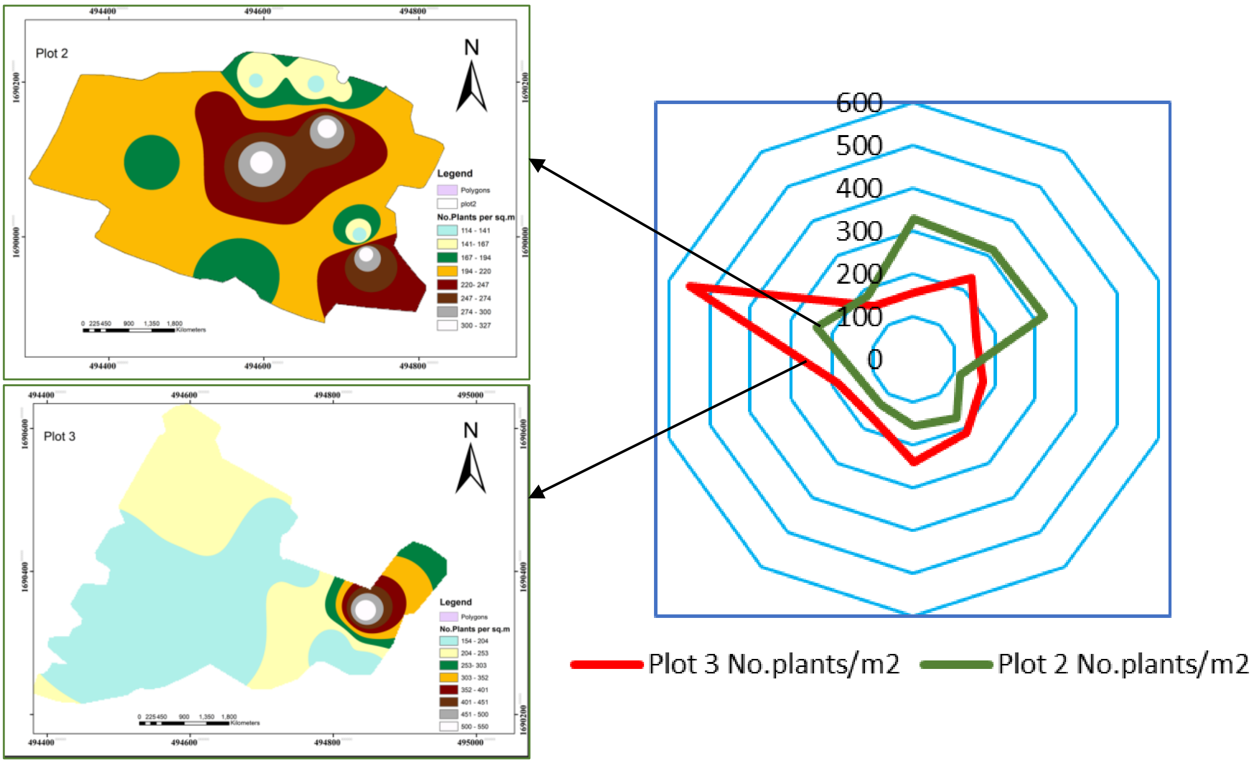

Fig. 1. Plot-wise Plant distribution mapping

Plot 3 generally had a greater number of plants per square meter and a higher mean (Table 1) compared to Plot 2, as well as a higher standard deviation (Table 1), which indicates greater variability compared to Plot 2. Plot 2 displays a slight positive skewness, suggesting some higher values (but not extreme), whereas Plot 3 shows a significant positive skewness, with higher kurtosis indicating the presence of an outlier (Fig.1).

Table 1

Comparison between the plant density values of the two sample plots

Statistic	Plot 2	Plot 3
Mean	209.1	222.3
Standard Deviation	84.2	119.6
Minimum	114	154
Maximum	327	550
Skewness	0.4	2.3
Kurtosis	-1.4	4.0

The statistical tests conducted on the two datasets revealed several key findings. The p-value of the Independent Samples t-test (Table 2) exceeded the significance level (0.05), indicating no statistically significant difference between the means of the two datasets. The Mann-Whitney U-test also supported this conclusion. This test showed no significant difference in the distributions of the two datasets, even when considering the non-normal distribution observed in Plot 3 (Fig.1). Moreover, the one-sample t-tests for each dataset further support these findings. The p-values of both plots were greater than 0.05, indicating that neither dataset's mean differed significantly from the hypothesized mean (200 plants/m^2).

Table 2

Independent t-Test and Mann-Whitney U Test

	Independent t-Test	Mann-Whitney U Test	One-Sample t-Test Plot 2	One-Sample t-Test Plot 3
t-statistic	-0.29	47.50	0.34	0.59
p-value	0.78	0.88	0.74	0.57

Despite the higher mean observed in Plot 3 (Table 1), statistical tests indicated that this difference is not significant. However, the greater variability highlighted the need to ensure consistent machinery operation and planting practices. By addressing the identified variability and its potential causes, the overall efficiency and consistency of wheat planting could be improved, leading to more reliable and optimal yields.

Conclusion:

1. The analysis showed that Plot 3 generally had a higher number of plants per square meter and a greater mean than Plot 2.
2. Plot 3 also exhibits significantly higher variability, positive skewness, and kurtosis. This suggests an inconsistency in planting practices.
3. The statistical tests indicated no significant difference between the means of the two plots, and the planting patterns were similar.
4. The overall difference in the plant population was 131, indicating that a similar number of seeds was sown over the two plots. However, the difference in extreme values may have been caused by imprecise guidance.

5. To improve this, operational strategies can be modified, such as implementing automation or precision-guided operations.

6. Practical implications include investigating environmental factors that may contribute to the high variability in Plot 3 and considering further studies with larger sample sizes and multiple potential factors to confirm these findings.

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INFORMATION AND ANALYTICAL TOOLS FOR ENSURING ENVIRONMENTAL SAFETY AT A MEAT PROCESSING PLANT

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Abstract: *The article brings up a question of environmental monitoring organization in agricultural businesses. The aim is to ensure the environmental safety of an economic entity.*