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Research Article

Irish potato culture: Good diversification in the collective gardens of onion producers in the Sudano-sahelian area of Cameroon

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Abstract

An adaptability trial was conducted in the Diamaré plain of the Far North of Cameroon to promote Irish potato cultivation and identify high-performing varieties suited to local agroecological conditions. Three improved varieties (UNICA, DOSA, and PAMINA) were evaluated using a randomized complete block design with four replicates. Agronomic and economic data were collected and analyzed with Statgraphics 5.0. software to determine the varietal performance and profitability. The results revealed significant differences among the varieties in terms of vegetative growth, tuber production, and economic returns. UNICA exhibited the most vigorous vegetative growth, reaching 75.2 cm height by 54 days after sowing. In contrast, PAMINA achieved the highest tuber yield of 82.65 t ha^{-1}. At harvest, DOSA produced the highest number of tubers per plant, whereas, the local variety recorded the lowest number (7.7 tubers per plant). The yield parameters varied significantly among the varieties. The average weight per plant ranged from 5.08 kg for the local variety to 10.33 kg for PAMINA. Similarly, the yields ranged from 40.69 t ha^{-1} (Local) to 82.65 t ha^{-1} (PAMINA). DOSA and UNICA demonstrated greater yield stability, as indicated by the distribution of their standard deviations relative to their medians. Economic analysis, based on field yields and market prices, showed that PAMINA generated the highest net profit (13,787,856 CFA francs), followed by DOSA (9,264,351 CFA francs) and UNICA (4,493,607 CFA francs), all of which outperformed the local variety. Overall, the findings suggest that Irish potato cultivation, particularly with DOSA and UNICA-offers a profitable alternative to onion production in the Diamaré plain. However, further multi-location trials are recommended to validate varietal adaptability across the wider Sudano–Sahelian zone.

1. Introduction

Potato (*Solanum tuberosum* L.) is a perennial herbaceous crop native to Latin America that can reach a height of up to one meter and produces underground tubers. It is the third most important food crop in the world after rice and wheat, including in parts of the Sudano–Sahelian region of Africa [1]. In recent years, potato production in Africa reached 26.23 million tons in 2020, compared with 354,404 tons in Cameroon [2]. In Cameroon, more than 80% of the national production comes from the West and North-West regions [3].

Potato cultivation generates significant income for producers compared with many other crops [4] and contributes to meeting household food demand in

national and sub-regional markets [5]. Beyond its income-generating potential, potatoes have been widely recommended in discussions on household food security [6, 7] due to the growing demand for both fresh and processed products [8]. Irish potatoes have high nutritional value, providing essential nutrients such as carbohydrates, dietary fiber, vitamins, and minerals, including potassium, magnesium, and iron [9, 10]. It is also associated with a reduced risk of certain chronic diseases due to its antioxidant content, particularly polyphenols [10]. Thus, potato cultivation can help combat food insecurity, malnutrition, and recurrent famine risks, especially in northern Cameroon.

The Sudano–Sahelian zone offers the potential for expanded potato production, particularly within crop rotation systems, such as potato–onion rotations [11]. However, onion profitability has declined in recent years due to price fluctuations, rising input costs, pest and disease pressures, and climate variability. In 2023–2024, the average onion price in the Sudano–Sahelian zone dropped to about 30,000 CFA francs, negatively affecting farmers' incomes [12].

In this context, crop diversification is essential for reducing economic risks and strengthening the resilience of market gardening systems [13]. Although potatoes are traditionally cultivated in the highlands of the Mandara Mountains, water shortages limit dry-season production. Recently, some farmers have begun cultivating Irish potatoes during the dry season in the Gawar and Diamaré plains (below 500 m altitude), where water resources are more available despite less favorable altitude conditions. Therefore, this study was initiated to assess the agronomic and economic potential of dry-season Irish potato production in the Diamaré plain. Identifying adaptable and profitable varieties is essential to ensure their successful adoption as viable alternatives to onion production.

2. Materials and methods

2.1. Description of the study site

The experiment was carried out at the research farm of the Center for Agricultural Research for Development (CRAM) in Maroua on an experimental plot with a length of 9 m and a width of 6.50 m. The farm is located in Mangalaré village, Meskine subdivision, approximately 10 km from Maroua city. The test site had geographical coordinates of 10°54.26 North and 14°25.04 East. It is located at an altitude of 414 m and covers an area of 10 ha [14]. The results of the laboratory soil of FASA (Dschang University) showed that the structure was sandy clay with 46,5% and 33% proportion, respectively. The pH was 5,9 et the CEC was 32,24 meq/100 g noted that the exchangeable base saturation and the proportion of organic matter were 17,91 meq/g and 6,76% respectively.

2.2. Plant materials

For the implementation of this research, three plant materials were collected from Ngaounderé and a local variety was provided in the Mogode area in the department of the Mayo-Tsanaga. For the seeds used, the size of the tubers of the improved varieties Irish potato ranges from 20 mm to 40 mm. These improved seeds were healthy, pre-germinated, and certified by the decentralized service (DRCQ) of Minader Adamawa for the G2 account. On the other hand, local seeds come from all sources, and their sizes of which were smaller, and varying from 10 mm to 15 mm in diameter.

2.3. Experimental design

Each variety constituted the treatment by attributing the letters U, P, D and L, respectively (Table 1). Each variety constituted treatment and was distributed randomly in the experimental design. The experimental field was 5 m width and 16m length. A randomized complete block design (RCBD) with four replicates was used.

2.4. Conduct the test in the field

The experiment started in November 2024 and ended in February 2025. Sixteen seedlings of 5 m each were prepared. Potatoes are planted on each seedling, planted following two lines. A total of 24 tubers were planted on each line. The spacing between the two plants on the line was 0.2 m. Irrigation was applied weekly until the maturation period began. With gravity irrigation, the average time taken for a furrow to fill was 4,5 min. Total of 1 h 25 min to irrigate the entire experimental plot. Two weeding as made. NPK (14-23-14) fertilizer was applied at a dose of 0.2 kg per linear meter at 36 DAS. The harvest took place on

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Table 1. Characteristics of different plant material tested.

Varieties	Treatment Codifications	Yields	Cycles	Origins
PAMINA	P	25-30 t/ha	95-100 days	Europe
UNICA	U	40-45 t/ha	75-105 days	Kenya
DOSA	D	40-45t/ha	60-120 days	IRAD Cameroun
Local variety	L	Indeterminate	Indeterminate	Indeterminate

02/26/2025 (96 DAS).

2.5. Data collection et analysis

In this study, parameters targeted were on one hand the size of the plant, number of ramifications and number of leaves. On the other hand, the average weight of 10 tubers, the number and weight of tubers per plant and the yield in tons per hectare. The Statgraphics 5.0. software was used to analyze the variance (Fisher test) at the 5% significance level, this allowed to compare the average values between the irish potato varieties for all quantitative parameters. The profit evaluation of Irish potato production was analyzed by the following formula:

Profit (CFA F) = *[yield (t/ha) * Pi] - total cost* (CFA F/ha) …… (1) [15].

Pi = Selling price of a potato bag CFA F

All input and output prices were valued at market prices at the time of the operation.

3. Results

3.1. Evaluation of growth and development parameters of 04 potatoes varieties

The evaluation of the growth and development parameters of the four potato varieties (Local, PAMINA, DOSA, and UNICA) revealed significant differences among the genotypes. In addition, Fig. 1 shows the average number of ramifications per variety of the tested potato. After 25, 40 and 54 days of growth, the variation in plant height was measured and the results are presented in Fig. 2.

The local variety exhibited the shortest plants at all observed phenological stages. At 25 days after sowing (25 DAS), its average height (21.2 cm) was more than twice lower than that of PAMINA (44.3 cm). Overall, UNICA showed the best vegetative growth performance, reaching 75.2 cm height at 54 DAS. Significant variation was also observed among the varieties in terms of the average number of plant branches. DOSA and PAMINA displayed

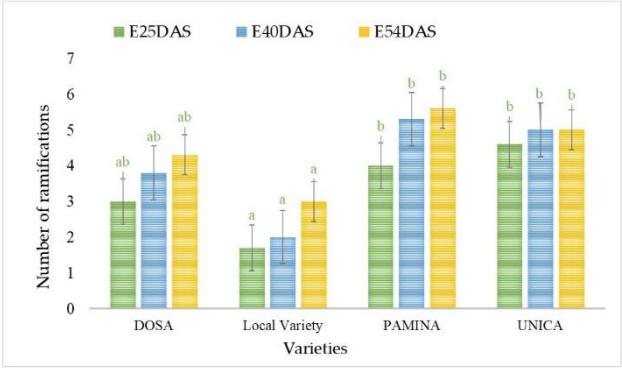

Figure 1. Average number of ramifications of 04 varieties of potatoes at different phonological stage.

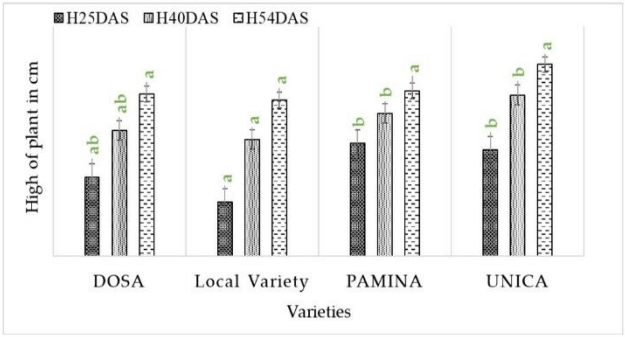

Figure 2. Histogram the size of 04 varieties of potatoes at different phonological stage.

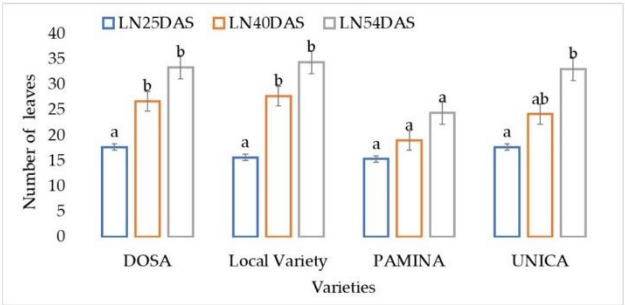

Figure 3. Number of leaves the 04 varieties of potatoes at different phonological stage.

intermediate values, positioned between the local variety, which showed weaker development, and UNICA, which recorded the highest growth performance. Fig. 3 presents the average number of

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Table 2. Yield component evaluation in kg.

Varieties of potato	Average weigh in kg of 10 tubers of potatoes	Average tubers per plant potatoes	Weigh in kg per plant potato	Yield in t/ha per varieties
Local variety	0.842 ± 0.002	7.750 ± 1.340	5.09 ± 0.562a	40.69 ± 5.234a
DOSA	0.875 ± 0.005	11.000 ± 2.145	8.64 ± 1.032ab	69.08 ± 2.245ab
PAMINA	0.910 ± 0.034	9.750 ± 2.235	10.33 ± 3.230b	82.65 ± 12.362b
UNICA	0.927 ± 0.025	9.000 ± 2.032	6.85 ± 0.892ab	54.77 ± 3.572ab
Probabilities	0.782	0.912	0.047	0.003

Table 3. Evaluation of the number of days of start flowering, tuberization and maturation of 04 varieties potato.

Varieties	NDSCM	NDST	NDSF
Local variety	88.15 ± 3.22	51.00 ± 4.92	55.35 ± 2.45ab
DOSA	89.6 ± 4.32	50.05 ± 3.47	59.05 ± 2.82b
PAMINA	88.55 ± 3.27	49.95 ± 2.65	52.80 ± 2.87a
UNICA	87.15 ± 5.37	50.00 ± 2.64	56.35 ± 3.90ab
Sig (P)	0.523	0.635	0.025

NB: NDSCM: Number of days at the start of commercial maturation, NDST: Number of days at the start of tuberization, NDSF: Number of days at the start of flowering.

leaves at different dates of 04 varieties of the potato. Fig. 3 presents how the average number of leaves varied with the potato plant age.

The analysis revealed clear varietal differences in the average number of branches per plant. The local variety developed the lowest number of branches, ranging from 2 to 3 during the observation period. In contrast, PAMINA recorded the highest number of branches, with 4 branches at 25 DAS and up to 6 branches at 54 DAS. From 25 DAS, UNICA plants had already developed all their branches (5), whereas branching in PAMINA progressed over time. These results indicate that branch development in potato plants varies according to both variety and growth stage. At 25 days after sowing (25 DAS), no significant differences were observed in the average number of leaves among the four potato varieties tested. However, significant differences emerged at 40 DAS. The Local variety recorded the highest average number of leaves (28), whereas PAMINA showed the lowest (20). Overall, PAMINA produced fewer leaves than the other tested varieties.

3.2. Evaluation of Irish potato yield components

Table 2 presents the analysis of variance of the obtained yields. The results indicated no significant difference ($p = 0.720$; $0.852 \geq 0.5$) in the mass of 10 randomly selected tubers among the four potato varieties. The average mass ranged from 0.82 to 0.92 kg. Varietal differences were observed in the number of tubers per plant. The DOSA variety produced the highest number of tubers per plant, whereas the local variety recorded the lowest number (7.7 tubers per plant).

Significant differences were also observed in the average production per plant and yield per hectare. The average weight per plant ranged from 5.08 kg (local variety) to 10.33 kg (PAMINA variety).

Similarly, the yield per hectare varied from 40.69 tons/ha (local) to 82.65 tons/ha (PAMINA). Overall, the Local variety recorded the lowest values for most yield components. Fig. 1 illustrates the distribution of the yield medians among the tested potato varieties. Table 2 indicates that PAMINA achieved the best yield performance among the tested varieties. With an average yield of 82.65 t/ha, PAMINA produced approximately twice as much as the local variety (40.69 t/ha) and about 20% more than DOSA.

Fig. 4 shows that DOSA and UNICA exhibited greater yield stability, as reflected by the lower dispersion of the standard deviation around their median yields. In contrast, PAMINA showed greater variability around the median yield. The Local variety also displayed notable variability, likely due to seed heterogeneity resulting from informal seed exchange and mixing among local producers.

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Table 4. Comparison of profits (cfa F/ha) of the 04 tested potato varieties.

Types of expenditures	DOSA	Local variety	PAMINA	UNICA
Seeds	1384615	1230770	1384615	1384615
Seeds transport	76925	30770	76925	76925
Rental of plot	70000	70000	70000	70000
Labor	40000	40000	40000	40000
Lockers confection	240000	240000	240000	240000
Sowing	160000	160000	160000	160000
Fuels for irrigation	268800	268800	268800	268800
Cost for irrigation	180000	180000	180000	180000
Cost for fertilizers	100000	100000	100000	100000
Cost for weeding	320000	320000	320000	320000
Cost for harvesting	160000	160000	160000	160000
Depreciation of the equipment	361250	361250	361250	361250
Total expenditure of potato production	*3 361 590*	*3 161 590*	*3 361 588*	*3 361 588*
Revenue per variety	23 028 841	13 564 490	27 552 344	18 258 095
Net profit per variety	19 667 251	10 402 900	24 190 756	14 896 507
Onion production cost	1 272 957.51			
Revenue of Onion	1 255 968.33			
Onion net profit	-16 989.18			

NB: Fuel: 700 F cfa/L, weigh in kg of one bag potato: 150 kg, number of lockers in Ha: 1600, selling price of potato bag: 50 000 F cfa, quantities of seeds for sowing one Ha: 2 tons (about 16 bags), purchase price of a seed bag: 80 000 F cfa for the Local variety and 90 000 F cfa for the certified varieties [18].

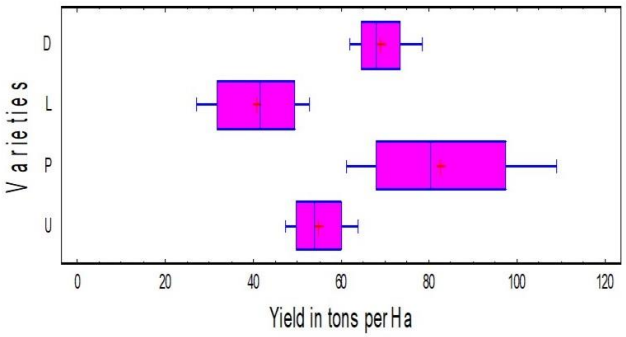

Figure 4. Distribution of the medians of yield in tons per hectare of the 04 potato varieties.
NB: D = DOSA, L = Local variety, P = PAMINA and U: UNICA

3.3. Evaluation of cultural cycle

Table 3 shows the number of days at the start of flowering, tuberization and start of maturation of 04 varieties of the potato. Table 3 shows that the number of days to the start of tuberization and maturation were almost similar among the tested potato varieties. The only significant difference was observed in the number of days until the start of flowering.

The DOSA variety required a longer period before flowering (59.35 days), whereas PAMINA flowered earlier (52.8 days). However, the differences decreased at commercial maturity. The number of days to commercial maturity (NDSCM) ranged from 87.15 to 89.6 days across varieties, indicating relatively close maturity periods. DOSA showed slightly longer maturation compared to the other varieties, with a difference of more than two days. However, given that production costs are generally calculated on a weekly basis, this small difference may not significantly affect the overall production expenses.

3.4. Economic analysis of onion and potato production

Table 4 presents the economic analysis (profitability) of the production of 04 varieties of the potato.

3.5. Economic analysis of onion and potato production

Table 4 indicates an increase of approximately 200,000 F CFA in production costs between the local and improved varieties. This additional cost is mainly attributed to transportation expenses and the purchase of improved seeds. When the yield is associated with the market price, the income varies considerably among the varieties. The highest gross income (27,552,344 F CFA/ha) was obtained with the PAMINA variety, whereas the Local variety generated the lowest income (13,564,490 F CFA/ha). In terms of net profit compared to the local variety,

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additional gains were estimated at: 13,787,856 F CFA for PAMINA; 9,264,351 F CFA for DOSA and 4,493,607 F CFA for UNICA. According to MINADER (2024), the total production cost of potato during the rainy season is about 2,162,500 F CFA, with a reported net profit of 262,041.75 F CFA. However, CRA DOSSO (2017) reported a higher gross margin of 1,023,750 F CFA in the Dosso region [32]. These results suggest that potato production, particularly with improved varieties, is more profitable than onions cultivation in Diamaré, where farmers traditionally grow onion during the dry season.

4. Discussion

4.1. Growth and development parameters of 04 potatoes varieties

The results demonstrated considerable variability in vegetative growth potential among the studied potato varieties. The lower plant height observed in the local variety may be attributed to its genetic characteristics or lower adaptability to the agro-ecological conditions of the study area. The superior performance of UNICA in terms of plant height and vegetative development suggests a greater growth potential, which may translate into enhanced photosynthetic capacity and potentially higher yield. These findings are consistent with the study conducted by Ünlühan and Erdoğan [16], who also reported significant varietal differences in Türkiye. In their study, the tallest plant was recorded in the Pomqueen (89.6 cm) and Kaya (85.5 cm) varieties, highlighting the strong influence of genotype on vegetative growth performance. Overall, the observed variability emphasizes the importance of variety selection in optimizing agronomic performance in potato production. The observed differences in branch number among the varieties highlight the strong influence of genotype on vegetative architecture. The lower branching capacity of the local variety may reflect limited vegetative vigor, whereas PAMINA and UNICA demonstrated greater branching potential, which could enhance canopy development and light interception.

These findings are in agreement with previous studies conducted in different agro-ecological contexts. In Egypt, the Burren cultivar produced the highest mean number of branches per plant across three growing seasons (4.871, 4.883, and 4.896), outperforming the Rosetta cultivar, as reported by Hafez et al. [17]. Similarly, in Ethiopia, the Shenkolla variety recorded the highest stem number per plant (7.3), whereas the Menagesha variety showed the lowest (2.5), with statistically significant differences among varieties, according to Tessema et al. [18]. Overall, these comparisons confirm that branching and stem production are largely genotype-dependent traits and may vary considerably depending on environmental conditions and varietal characteristics.The absence of significant differences at 25 DAS suggests that early leaf development is relatively similar among the studied varieties. However, the significant variation observed at 40 DAS indicates that leaf production becomes more genotype-dependent as the plant growth progresses.

The lower leaf number recorded in PAMINA may reflect varietal differences in vegetative growth patterns, particularly in canopy architecture and biomass allocation. Since leaves are directly involved in photosynthesis, such differences may influence dry matter accumulation and ultimately tuber yield. These findings are consistent with the previous studies. Namugga et al. [19] reported that Irish potato varieties can exhibit significant differences in plant height, number of primary branches, and tuber yield, highlighting the strong genetic influence on vegetative traits. Similarly, Tessema et al. [18] found that varieties such as Viz, Marachere, Guassa, Chiro, and Awash developed the minimum number of leaves per plant. Furthermore, Masarirambi et al. [20] and Zebenay [21] reported in studies conducted in Zimbabwe and the central highlands of Ethiopia that leaf number differences were significantly influenced by plant density and seed size. Generally, the results confirm that leaf development in potato is determined not only by genetic factors but also by agronomic practices and environmental conditions.

4.2. Yields component of Irish potato varieties

The absence of significant differences in the mass of the 10 tubers suggest that tuber size may be relatively stable across varieties under the same growing conditions. However, the significant variation observed in the number of tubers per plant and the total yield indicates that the yield performance is

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strongly influenced by varietal characteristics. The higher number of tubers produced by DOSA and the superior yield performance of PAMINA highlight the importance of genetic potential in determining productivity. As reported by Asefa et al. [22], differences in the number of tubers tuber per plant are mainly attributed to genetic variation among potato varieties. Improved crop performance also depends on appropriate agronomic management. According to Tufan and Öztürk [23], successful crop intensification requires adherence to recommended practices, particularly proper fertilizer and pesticide application, as well as the use of improved seed varieties. Comparable findings were reported in Iraq, where the Caruso cultivar produced the highest number of tubers per plant (4.67 tubers/plant), as noted by Luqman et al. [24]. Similarly, in Egypt, the Burren cultivar achieved superior production in terms of tuber weight across three growing seasons (140.04, 142.08, and 146.00 g), as reported by Hafez et al. [17].

In general, the local variety consistently showed lower yield performance, suggesting limited genetic potential or reduced adaptability compared to the improved varieties. These findings emphasize the critical role of varietal selection and agronomic management in maximizing the productivity of Irish potatoes. The superior yield performance of PAMINA confirmed its high genetic potential under the study conditions. Compared to the yield levels reported in other countries, the performance observed in this study was relatively high. In Morocco, for example, the yields ranged from 15 to 50 t/ha depending on the variety and production conditions, according to INRA [25]. Similarly, Hafez et al. [17] reported that the Burren cultivar outperformed Rosetta, producing 16.48, 17.73, and 20.66 t/ha in three seasons. In Niger, average potato yields are reported to be around 18.8 t/ha. In Iran, yield performance varied among genotypes, with some showing higher yield potential than others, as reported by Arshadi et al. [26]. In Ethiopia, higher yields have been recorded under improved management and genotypic selection. Asefa et al. [22] reported a maximum yield of 46.1 t/ha from the advanced clone CIP-392640.524, followed by Belete (41 t/ha). In Western Ethiopia, Tilahun et al. [27] found yields ranging from 21.51 to 26.56 t/ha across multiple locations.

Yield stability is a critical factor in varietal recommendations. The relative stability of DOSA and UNICA suggests better adaptability to different conditions. Conversely, the variability observed in PAMINA may be attributed to varietal impurities or heterogeneity. According to Finlay and Wilkinson [28], the mean yield across environments and regression coefficients are key indicators of cultivar adaptation and stability. Thus, with regard to our context, the similarities that exist between these two regions from a climatic point of view show that the average temperatures range from 24.2°C to 36.5°C in the Far North and from 19.5°C to 34.2°C in Adamaoua during September, to January [29].

Small shifts in the minimum and maximum average temperatures did not influence the risks and key determinants related to these two regions (the Far North and Adamaoua), whose similar characteristics are based on the dominance of cool humid winds and prolonged rainfall in September. In November, they experience intense rising warm air that comes into contact with cold and humid air. During the same month, we also observed the predominance of dry and cold winds from the northeast. Finally, from December to January, cold and dry winds blow during the night and morning. This leads to the conclusion that the varieties produced in the Adamaoua zone can be adapted to the climatic conditions of the Far North during this period.

Further studies in Ethiopia showed that the Milki variety (CIP-394640.539) had strong yield stability across environments [30], whereas Tessema et al. [18] reported that Belete produced up to 32.8 t/ha total yield in the central highlands. In Iraq, Luqman et al. [24] found that the Jelly variety achieved yields of about 34.14 t/ha. Overall, the findings highlight that yield performance is strongly influenced by the genotype, environmental conditions, and management practices. Environmental variability often contributes more to yield variation than genetic factors, as observed in Malawi where environmental effects accounted for 62.86% of the yield variance compared to 14.25% from genotype variation. Therefore, beyond yield potential, varietal selection should also consider yield stability, adaptability, and

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crop cycle duration to ensure suitability to local agro-ecological conditions.

4.3. Cultural cycle of production Irish potato tested

The similarity in days to tuberization and commercial maturity suggests that the tested varieties belong to comparable maturity groups, despite differences in their flowering time. The delayed flowering observed in DOSA may reflect varietal genetic characteristics that influence phenological development. The NDSCM values recorded in this study are consistent with the findings of Tesfaye et al. [31], who reported that the Awash potato variety reached maturity at 89 days in Northern Ethiopia. However, the same authors noted that the farmers' cultivar Agere required up to 108 days to reach maturity, highlighting the influence of genotype on the crop cycle duration.

Although DOSA exhibited slightly longer maturation compared to PAMINA and the Local variety, the difference of a few days may not significantly impact production costs when management operations are scheduled weekly. Therefore, the choice of variety should consider not only earliness but also the yield performance and stability. Furthermore, Tessema et al. [18] reported that the interaction between variety and environment had no significant effect on traits such as days to 50% flowering, specific gravity, and dry matter content, suggesting a relatively stable varietal performance across locations. Overall, the results indicate that while flowering time differs among varieties, commercial maturity remains relatively similar, and varietal selection should integrate maturity class, yield potential, and adaptation to local agro-ecological conditions.

4.4. Economic analysis of onion and potato production

Although improved varieties involve higher initial production costs, mainly due to certified seed purchase and transportation, their significantly higher yields result in substantially greater income and net profits. The economic advantage observed with PAMINA highlights the importance of investing in improved varieties to maximize profits. Compared to the local variety of the potato, the most values (net profit) are 13 787 856 cfa F; 9 264 351 cfa F; 4 493 607 cfa F obtained respectively for the PAMINA, DOSA and UNICA varieties. The total charge of potato production in the rainy season is 2 162 500 cfa F, while the net profit is 262 041.75 cfa F [3]. However, it was noticed that the gross margin of 1 023 750 cfa F in the DOSSO region [32].

The comparison with onion production suggests that potato cultivation could serve as a competitive alternative crop. From a production perspective, potatoes may act as a substitute for onions among farmers, offering similar or greater financial returns. However, from a consumer standpoint, onions and potatoes are often consumed together in fixed proportions in many households, which may characterize them as complementary goods. Access to agricultural credit plays a key role in enhancing productivity and profits as noted by Mugumaarhahama et al. [33], agricultural credit enables farmers to purchase improved seeds, fertilizers, and hire labor, thereby increasing farm productivity and income. Moreover, proximity to markets reduces transaction costs and improves access to market information, thereby further strengthening profitability. Overall, the higher income generated by improved potato varieties can contribute to long-term household poverty reduction through reinvestment in productive assets, including natural and human capital.

5. Conclusions

At the end of this study, which aimed to evaluate the adaptability of Irish potato varieties in the Diamaré Plain of the Sudano-Sahelian zone of Cameroon, clear differences were observed among the tested varieties in terms of growth performance, yield, stability, and economic profitability. The PAMINA variety recorded the highest yield, reaching approximately 82.65 t/ha, demonstrating superior productive potential under the agro-ecological conditions of the study area. However, despite its high productivity, PAMINA showed greater variability around the median yield, suggesting a relatively lower yield stability. In contrast, DOSA and UNICA exhibited more stable yield performances, with less dispersion around their median values. Although their yields were slightly lower than those of PAMINA, their greater stability makes them more reliable under variable environmental conditions. Therefore, from

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the perspectives of risk management and sustainability. DOSA and UNICA may be preferable for cultivation.

Economically, Irish potato production, particularly with DOSA and UNICA varieties, represents a viable and profitable alternative to onion cultivation in the dry season in the Sudano-Sahelian zone of Cameroon. Given the comparative profitability and agronomic performance observed, potato farming can serve as a substitute strategy for onion production in the Diamaré Plain. To strengthen and generalize these findings, it is recommended to conduct multi-location trials across different sites within the Sudano-Sahelian zone. Such broader evaluations would allow for a more comprehensive assessment of varietal adaptability, yield stability, and economic performance under diverse environmental conditions.

Disclaimer (artificial intelligence)

Author(s) hereby state that no generative AI tools such as Large Language Models (ChatGPT, Copilot, etc.) and text-to-image generators were utilized in the preparation or editing of this manuscript.

Authors' contributions

Conceptualization, data curation, funding acquisition, investigation, methodology, formal analysis writing original draft, P.D.S.; software, validation, visualization, review and editing, J.T.K.; data curation, methodology, resources, review and editing, P.M.; formal analysis, methodology, review and editing, L.L.C.N.

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Availability of data and materials

All data will be made available on request according to the journal policy.

Conflicts of interest

The authors declare no conflicts of interest.

References

1. Gina, K.; Jessica, E.; Raneri, D.S.; Simon, A.; Gabriela, B.; Hernán, C.; Beatrice, E.; Vincent, J.; Jan, W.; Low, E.F.T. Roots, tubers and bananas: Contributions to food security. Encyclop. Food Secur. Sustain. 2019, 1(3), 231-256. https://doi.org/10.1016/B978-0-08-100596-5.21537-0
2. FAOSTAT. La pomme de terre en Afrique centrale: situation et perspectives. 2022.
3. MINADER. Fiche technico économique de production et de postproduction de pomme de terre. 2024.
4. Weidmann, G.; Kadzere, I.; Berge, P.V.L.T. Manuel de formation en agriculture biologique pour l'Afrique. Un manuel de ressources pour les formateurs au Cameroun. 2019. Online at www.organic-africa.net
5. Sadoung, O.; Yakana, G.; Fossi, L. Rapport de diagnostic de la filière pomme de terre au Cameroun. Centre International de la Pomme de Terre. 2023. https://doi.org/10.4160/9789290606581
6. Baddour, A.; Masoud, A. Response of two potato cultivars to organic fertilization and potassium foliar application. J. Soil Sci. Agric. Eng. 2022, 13(2), 51-58. https://doi.org/10.21608/jssae.2022.125730.1063
7. Muthoni, J.; Shimelis, H.; Mashilo, J. Production and availability of good quality seed potatoes in the East African region: A review. Aus. J. Crop Sci. 2022, 16(7), 907-915. https://doi.org/10.21475/ajcs.22.16.07.p3566
8. Kajunju, N.H.B.; Atukwase, A.; Tumuhimbise, G.A. Potato processing in Uganda: A technical review. Makerere Univ. J. Agric. Environ. Sci. 2021, 10(1), 60-81.
9. DeJong, H. Impact of the potato on society. Am. J. Potato Res. 2016, 93(5), 415-429. https://doi.org/10.1007/s12230-016-9529-1
10. Zaheer, K.; Akhtar, M.H. Potato production, usage, and nutrition, a review. Critic. Rev. Food Sci. Nutr. 2016, 56 (5), 711-721. https://doi.org/10.1080/10408398.2012.724479
11. GIZ ProCISA. Bonnes Pratiques Agricoles de Production de Pomme de terre de Consommation au Cameroun. Manuel du producteur, Yaoundé, 2018.
12. Agripreneurs d'Afrique. Au Nord du Cameroun, les producteurs d'oignon face aux chutes de rendement. 2024. https://agripreneursdafrique.com/article/au-nord-du-cameroun-les-producteurs-d-oignon-face-aux-chutes-de-rendement.
13. Chipungu, F.; Wisdom, C.; Aggrey, A.; John, S.; Nzola, M.; Jonathan, M. Adaptation of sweet potato (*Ipomoea batatas* L., Lam) genotypes in various agro-ecological zones of Malawi. Afr. J. Biotechnol. 2018, 17(16), 531-540. https://doi.org/10.5897/AJB2017.16352

14. Sakatai, D.P.; Seini, D. Comparative efficacy of five insecticides against key insect pests of dry-season onion (*allium cepa* l.) in Meskine, far north Cameroon. Plant Protec. 2024, 08 (02), 201-215. https://doi.org/10.33804/pp.008.02.5024
15. Sakatai, D.P.; Chendjou, R.; Olina bassala, J.P.; Sobda, G.; Kamga, R.T.; Hamidou, A.A.; Caractérisation de cinq variétés d'oignons (*Allium cepa.* L) à partir des paramètres physiques de la maturation des bulbes en vue d'optimiser leur production à l'Extrême-Nord Cameroun. Afr. Sci. 15(1) (2019) 314–331.
16. Ünlühan, T.; Erdoğan, Ö. Growth, yield components and tuber yield responses of potato (*Solanum tuberosum* L.) varieties in high altitude regions of Türkiye. J. Agric. Prod. 2024, 5(2), 131-137. https://doi.org/10.56430/japro.1455368
17. Hafez, O.M.; Abuol-Nasr, M.H.; Dalia M.T.; Nassef, M.A. Gameh. Effect of organo-mineral fertilization on vegetative growth and productivity of potato under the new valley conditions. J. Plant Prod. Mansoura Univ 2017, 8(6), 685-691. https://doi.org/10.21608/jpp.2017.40521
18. Tessema, L.; Mohammed, W.; Abebe, T. Evaluation of potato (*Solanum tubersum* L.) varieties for yield and some agronomic traits. Open Agric. 2020, 5(1), 63-74. https://doi.org/10.1515/opag-2020-0006
19. Namugga, P.; Sibiya, J.; Melis. R.; Barekye, A. Phenotypic characterisation of potato (*Solanum tuberosum*) genotypes in Uganda. South Afr. J. Plant Soil, 2018, 35 (1), 207-214. https://doi.org/10.1080/02571862.2017.1370561
20. Masarirambi, M.T.; Mandisodza, F.C.; Mashingaidze, A.B.; Bhebhe. E. Influence of plant population and seed tuber size on growth and yield components of potato (*Solanum tuberosum*). Int. J. Agric. Biol. 2012, 14(1), 545-549. http://www.fspublishers.org
21. Zebenay, D. Influence of seed tuber size and plant spacing on potato (*Solanum Tuberosum* L.) Production in Wolmera District, Central Ethiopia. Msc. Thesis, Haramaya University, Haramaya, Ethiopia, 2015.
22. Asefa, G.; Mohammed, W.; Tesfaye, A. evaluation of potato (*solanum tuberosum* l.) genotypes for resistance to late blight at SINANA Southeastern Ethiopia. Int. J. Agril. Res. Innov Tech, 2016, 6 (1), 21-25. https://doi.org/10.3329/ijarit.v6i1.29208
23. Tufan, Ü.; Öztürk, E. Growth, yield components and tuber yield responses of potato (*Solanum tuberosum* L.) varieties in high altitude regions of Türkiye. J. Agric. Prod. 2024, 5(2), 131-137. https://doi.org/10.56430/japro.1455368
24. Luqman, G.K.B.; Sidiq, A.S.K.; Aram, S.A. Evaluation of yield and some physiochemical traits in four cultivars of potatoes (*Solanum tuberosum* L.). Diyala Agric. Sci. J. 2023, 15(1), 72-80. https://dx.doi.org/10.52951/dasj.23150108
25. INRA. Fiche technique de la production de la pomme de terre, royaume du Maroc. 2024.
26. Arshadi, A.; Karami, E.; Sartip, A.; Zare, M.; Rezabakhsh, P. Genotypes performance in relation to drought tolerance in barley using multi-environment trials. Agron. Res. 2018, 16(1), 5-21. https://doi.org/10.15159/AR.18.004
27. Tilahun, W.F.; Abraham, N.F. Yield stability analysis of elite irish potato (*Solanum tuberosum* L.) varieties in Western Ethiopia. Int. J. Biochem. Biophys. Mol. Biol. 2021, 6(1), 6-10. https://doi.org/10.11648/j.ijbbmb.20210601.13
28. Finlay, K.; Wilkinson, G. The analysis of adaptation in a plant-breeding program. Aus. J. Agric. Res. 1963, 14(6), 742-754. https://doi.org/10.1071/AR9630742
29. ONACC, Forecasts and decadal climatic alerts, September, October, November, December and January, 2026. www.onacc.cm
30. Beriso, M.; Seifuddin, M.; Yonas, W.; Getachaw, A.; Registration of "Milki" a newly released potato variety for bale highlands, Ethiopia. Int. J. Agric. Econ. 2016, 1(3), 2016, 67-70. https://doi.org/10.11648/j.ijae.20160103.13
31. Tesfaye, A.; Wongchaochant, S.; Taychasinpitak, T.; Leelapon, O. Dry matter content, starch content and starch yield variability and stability of potato varieties in Amhara region of Ethiopia. Kasetsart J. (Nat. Sci.). 2012, 46 (1), 671-683.
32. CRA DOSSO. Fiche technico-économique pour la culture de la pomme de terre, 2017. Rédigé par la Chambre Régionale d'Agriculture de Dosso en association avec la Fédération des Coopératives Maraîchères du Niger.
33. Mugumaarhahama, Y.; Mondo, J.M.; Cokola, M.C.; Ndjadi, S.S.; Mutwedu, V.B.; Kazamwali, L.M.; Cirezi, N.C.; Chuma, G.B.; Ndeko, A.B.; Ayagirwe, R.B.B.; Civava, R.; Karume, K.; Mushagalusa, G.N. Socio-economic drivers of improved sweet potato varieties adoption among smallholder farmers in South-Kivu Province, DR Congo. Sci. Afr. 2021, 12(1), e00818. https://doi.org/10.1016/j.sciaf.2021.e00818