APPENDIX 4:
FINANCIAL ANALYSIS FINAL REPORT

An in-depth comparative farm-level financial analysis of different production systems in selected maize-based regions of South Africa

Phase 2: Quantitative analysis

Comparing producer's actual production cost data between different production practices

September 2024

FINAL REPORT

An in-depth comparative farm-level financial analysis of different production systems in selected maize-based regions of South Africa

Phase 2: Quantitative analysis - Comparing producer's actual production cost data between different production practices

For the period:

October 2023 to September 2024

Compiled by:

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Funded by:

The Maize Trust

Executive Summary

This report presents an in-depth financial analysis of different maize production systems across key maize-producing regions in South Africa: the Northwest Free State (NWFS), North West (NW), and the Eastern parts of the country. The analysis compared Conventional Tillage (CT), No-till/Conservation Agriculture (NT/CA), and Transition Phase (TP) practices. The overarching goal of this study was to assess the profitability, sustainability, and input efficiency of these farming systems, enabling stakeholders to make informed decisions that enhance agricultural productivity.

Maize production in South Africa is characterised by diverse farming practices, each with its unique cost structures and challenges. With increasing global and local pressures such as climate change, input costs, and market volatility, producers are seeking sustainable approaches to enhance profitability and production efficiency. This report focused on achieving the following aims:

- To evaluate the profitability and sustainability of different maize farming systems.
- To identify trends in production costs and input efficiency over a five-year period.
- To improve transparency in cost practices among producers.

The research methodology initially planned to include data from 40 producers across four regions but faced challenges in gathering detailed production cost data directly from maize producers. Alternative methods, such as sourcing data from agribusinesses and private companies were followed. Data was sourced from 38 producers and stakeholders due to challenges in direct data collection from producers, providing a comprehensive view of actual production costs for CT, TP, and NT/CA systems across the NWFS, NW, and Eastern parts of South Africa.

In the NWFS region, NT/CA systems showed significant improvements in both yield and profitability over time. Despite initially incurring higher input costs, NT/CA practices outperformed CT by 2022–2023, with net margins 59% higher than CT. This was primarily due to the long-term benefits of conservation agriculture, including better soil health and improved input efficiency, leading to reduced costs and more stable yields. Over the 5-year period, total variable production costs consistently increased across all systems due to increasing input prices, especially for fertiliser, pest control and fuel. NT/CA systems demonstrated a significant increase in yields by 2022–2023, surpassing CT by 11%. This suggests that conservation agriculture practices, once established, can lead to stable and improved yields due to better soil health and water retention.

Like NWFS, total variable costs for all systems increased over the years, with NT/CA systems experiencing higher costs compared to CT. By 2022–2023, NT/CA systems had 10% higher total variable costs compared to CT, indicating that input efficiency in this region still requires improvement, particularly for chemical inputs. NT/CA systems in NW showed steady yield improvements over the 5-year period. By 2022–2023, NT/CA yields were 24% higher than CT and 13% higher than TP.

In the Eastern parts of South Africa, NT/CA systems encountered more volatility in yields and profitability compared to CT. While CT systems generally showed more stable profitability, NT/CA practices faced greater financial pressure due to higher break-even yields and prices. By 2023, NT/CA

had a negative profitability of -14%, reflecting challenges in managing input costs and achieving consistent yields. This suggests that NT/CA practices in this region require further adaptation and support to overcome these hurdles and realise their long-term potential. Fertiliser again represented the largest share of input costs across all systems, while pest control costs for NT/CA systems were particularly high due to the need for more intensive weed and pest management. Fuel and maintenance costs were lower for NT/CA compared to CT, aligning with reduced machinery usage. NT/CA systems in the Eastern region displayed more volatility in yield performance, this fluctuation reflects the challenges of adapting NT/CA practices in this region.

This report successfully addressed the research question: What were the actual production costs per hectare for Conventional Tillage (CT), No-till (NT), and Conservation Agriculture (CA) systems in the main maize-producing areas of South Africa? By conducting a detailed retrospective comparative financial assessment across key regions (NWFS, NW, and the Eastern parts), the analysis provided a clear understanding of profitability on a per-hectare basis. Using both historical and actual production cost data, this study enabled a thorough comparison of the three systems, shedding light on the economic efficiency of each practice.

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1. Introduction

The agricultural landscape in South Africa is characterised by a wide array of farming practices, each contributing uniquely to the economy and the environment. With increasing pressures from climate change, resource scarcity, and the need for sustainable production, producers are continually seeking ways to optimise their operations. The analysis focused on comparing the performance of Conventional Tillage (CT) and No-till/Conservation Agriculture (NT/CA) across three significant regions: the North West Free State (NWFS), North West (NW) and the Eastern parts of South Africa. By examining critical metrics such as yield, profitability, break-even yield, and break-even prices, we aim to understand the effectiveness and financial viability of these practices. Understanding these metrics is essential, as they navigate the complexities of modern agriculture and make informed decisions to enhance productivity.

This report represents Phase 2 of a two-part comprehensive analysis on maize production systems in South Africa. While Phase 1 focused on qualitative assessments of production practices, including preliminary observations and stakeholder insights, Phase 2 delves into the quantitative analysis of financial performance across three maize farming systems and should be read in conjunction with Phase 1 to fully understand the context and rationale. Together, both phases provide a holistic view of maize farming practices, combining qualitative and quantitative insights with in-depth financial analysis to support data-driven decision-making in agriculture.

The insights gathered from this analysis will not only provide a clearer picture of the current agricultural landscape but also contribute to the ongoing dialogue on sustainable farming practices in South Africa. It is important to note that the actual production cost figures presented in this analysis were sourced from specific data sets, and there remains uncertainty about how these figures might differ if alternative sources/producers' data were used.

2. Aim

Overall, the aim is to create a comprehensive understanding of maize production costs, efficiency and profitability across different farming operations, enabling stakeholders to make informed decisions that enhance agricultural productivity and sustainability. Sub aims are the following:

a. To evaluate the sustainability and profitability of different farming practices by analysing their cost structures over a 5-year period.
b. To identify trends in production costs and input efficiency over time, providing a basis for forecasting future performance and identifying emerging challenges or opportunities in maize farming.
c. To improve transparency in cost practices among producers, which can lead to greater accountability and more informed discussions about agricultural practices.

Considering the aims mentioned above this proposal seeks to answer the following research question: What were the actual production cost per ha for CT, NT and CA systems in the main maize-producing areas of South Africa?

3. Objectives

a. To select farms and farmer co-workers that represent typical conventional practices (CT) and no-till/conservation agriculture (NT/CA) systems in specific key maize-producing regions in South Africa. Approximately 4 regions are envisaged and 5 producers representing each system.

b. Request detailed data from maize producers to obtain their actual production cost for the past 5 years.

4. Research method

The initial plan for the project was to select producers who represent typical conventional practices (CT) and no-till/conservation agriculture (NT/CA) systems across key maize-producing regions in South Africa. The selection aimed to include 40 producers in total, with 5 producers from each category (CT and NT/CA) in approximately four areas. This approach was designed to provide a representative comparison of production systems.

Table 1 Initial plan: Producer selection per production practice

Production region	Conventional practice (CT)	No-Till (NT)/ Conservation Agriculture (CA):	Total
Eastern parts (Mp & GP, EFS)	5	5	**10**
Free State (North & West)	5	5	**10**
Northwest	5	5	**10**
Kwazulu-Natal	5	5	**10**
Total	**20**	**20**	**40**

However, several challenges were encountered in the data collection process, particularly in gathering accurate production cost data from producers. Some general reasons why it was challenging to obtain actual production cost figures directly from maize producers were:

- **Incomplete record-keeping:** Many producers do not maintain records of their production costs. They often only capture essential data, such as input quantities and yield, which makes it difficult to obtain a full picture of their total production costs.
- **Lack of standardised data collection:** There is no standardised method for producers to capture production cost data, leading to inconsistencies in the information available.

- **Confidentiality concerns:** Some producers are hesitant to share their cost data due to privacy concerns or fears of exposing sensitive financial information.
- **Time and resource constraints:** Producers are often constrained by time and resources, making it difficult for them to consistently track detailed cost data.
- **Variability in production practices:** The variability in farming practices and external factors, such as weather conditions and market fluctuations, adds complexity to capturing and comparing production costs across different regions and systems.

Due to the above challenges, alternative methods were sought to obtain the necessary production cost data. The project team reached out to agribusinesses, private companies, and individuals who either capture producers' actual production costs as part of study groups or have producers as clients where benchmarking work is done for service delivery.

This alternative approach proved to be successful, with good participation from these alternative sources. The data obtained through this route allowed for a more comprehensive analysis, resulting in the identification of three distinct categories and not the original two categories as identified:

1. Conventional Practice (CT): Traditional farming methods with conventional tillage.
2. CT to NT/CA (Transition Phase): Producers in the process of transitioning from conventional practices to no-till/conservation agriculture (NT/CA).
3. No-till/conservation agriculture (NT/CA): Producers who have fully adopted no-till or conservation agriculture practices.

The data in Table 2 represent the distribution of maize producers across key maize-producing regions in South Africa. Production cost data were collected from three areas: the Eastern Parts of South Africa, the Northwest Free State, and the North West province. In total, data from 38 producers were obtained. Most data were collected from producers practising conventional tillage (20). Eleven producer's data transitioning from conventional tillage to no-till/conservation agriculture were gained while data from only 7 producers who have fully adopted no-till/conservation agriculture practices were obtained.

Table 2 Producer selection per production practice

Production region	Conventional practice (CT)	CT to NT/CA: Transition phase (TP)	No-Till (NT)/ Conservation Agriculture (CA):	Total
Eastern parts of SA	10	-	2	**12**
Northwest Free State	5	5	1	**11**
North West	5	6	4	**15**
Total	**20**	**11**	**7**	**38**

5. Data Analysis

For the comparison analysis, a uniform producer price for maize was used to provide a clearer picture of the current profitability situation between the different production practices, given the numerous variables involved. Any data with incomplete or inconsistent production costs were excluded from the

analysis to maintain accuracy and reliability. It is important to note that while the data obtained from different sources varied, efforts were made to standardise the information as much as possible to ensure comparability across the different farming practices.

In the analysis of the NWFS and North West regions, three different practices will be compared, while only two practices will be examined for the Eastern parts of South Africa, as no Transitioning Practice (TP) data was obtained for that region

6. Results

6.1 Data analysis per region: Northwest Free State (NWFS):

Note:

The tables and graphs for this region will be discussed in detail, whereas those for the other 2 areas will be covered more briefly.

Key observations for the Northwest Free State

Table 3 below shows detailed actual production costs while Table 4 shows the comparison of various metrics and efficiency ratios across different categories of maize producers (Conventional Tillage (CT), CT to NT/CA transition, and no-till/conservation agriculture (NT/CA).

Table 3 Summary of combined actual production cost for each production practice of the NWFS (5-year period)

Summary calculations: North West Free State production area: Average of all producers per year as per production practise															
	Conventional Farmer (CT)					Conventional to Conservation (Transitional phase - TP)					No-till/Conservation Farmers (no-till/CA)				
	Average of all CT Farmers					Average of all CT to CA Farmers					Average of all no-till/CA Farmers				
	CT 2019	CT 2020	CT 2021	CT 2022	CT 2023	CT-CA 2019	CT-CA 2020	CT-CA 2021	CT-CA 2022	CT-CA 2023	CA 2019	CA 2020	CA 2021	CA 2022	CA 2023
Year	**2019**	**2020**	**2021**	**2022**	**2023**	**2019**	**2020**	**2021**	**2022**	**2023**	**2019**	**2020**	**2021**	**2022**	**2023**
Yield (t/ha)	5,3	6,6	5,1	3,5	6,1	4,9	7,2	4,5	4,2	6,6	5,3	6,1	4,9	4,3	6,3
Average Producer Price (R/ton)	2 382	2 686	3 030	4 064	3 179	2 382	2 686	3 030	4 064	3 179	2 382	2 686	3 030	4 064	3 179
Gross Farm income (GFI)	**12 599**	**17 763**	**15 414**	**14 166**	**19 323**	**11 772**	**19 256**	**13 503**	**17 157**	**21 015**	**12 622**	**16 383**	**14 849**	**17 474**	**20 029**
Direct variable cost															
Seed	1 522	1 197	1 327	1 601	1 552	1 486	1 523	1 730	1 546	1 548	1 473	1 784	1 687	1 684	1 694
Fertiliser	2 093	2 664	3 018	3 809	6 200	2 044	2 643	3 056	4 018	6 414	2 218	2 358	3 054	4 010	6 587
Lime	0	78	0	99	152	0	47	0	78	141	0	210	265	274	201
Chemical cost	699	819	1 046	1 145	1 556	683	775	947	1 025	1 550	1 154	1 214	1 347	1 014	1 247
Insurance (hail)	127	148	46	164	341	124	138	153	133	358	0	123	135	147	200
Marketing cost	55	24	50	32	53	54	26	75	95	43	65	50	64	55	78
Contract work	82	80	197	208	349	113	236	165	162	296	0	167	0	0	0
Labour	92	32	238	221	250	72	120	262	131	202	45	36	54	78	64
Fuel	1 092	882	847	1 301	1 276	1 067	853	874	1 248	1 329	645	754	798	1 047	1 147
Repair and maintenance	564	635	612	408	1 036	551	720	804	525	1 018	359	532	554	601	687
Transport cost	0	98	264	153	118	0	180	436	72	95	0	114	245	101	125
Total variable cost	**6 328**	**6 658**	**7 646**	**9 142**	**12 885**	**6 192**	**7 261**	**8 502**	**9 032**	**12 994**	**5 959**	**7 342**	**8 203**	**9 011**	**12 030**
Total overhead cost	**3 417**	**3 512**	**3 638**	**2 140**	**3 334**	**3 522**	**3 618**	**3 394**	**3 314**	**3 401**	**3 168**	**3 475**	**3 358**	**3 575**	**3 380**
Total cost	**9 745**	**10 171**	**11 284**	**11 282**	**16 219**	**9 714**	**10 879**	**11 896**	**12 346**	**16 395**	**9 127**	**10 817**	**11 561**	**12 586**	**15 410**
Farming profit/loss	**2 854**	**7 592**	**4 131**	**2 884**	**3 104**	**2 058**	**8 377**	**1 608**	**4 811**	**4 619**	**3 495**	**5 566**	**3 288**	**4 888**	**4 619**

Table 4 Summary of margin, break-even calculations and efficiency ratios for each production practice of the NWFS (5-year period)

North West Free State production area: Average of all producers per year as per production practise															
	Conventional Farmer					Conventional to Conservation					No=till/Conservation Farmers				
SUMMARY	Average of all CT Farmers					Average of all CT to CA Farmers					Average of all NT/CA Farmers				
	CT 2019	CT 2020	CT 2021	CT 2022	CT 2023	CT-NT/CA 2019	CT-NT/CA 2020	CT-NT/CA 2021	CT-NT/CA 2022	CT-NT/CA 2023	NT/CA 2019	NT/CA 2020	NT/CA 2021	NT/CA 2022	NT/CA 2023
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
1) NETT MARGIN															
Nett margin (R/ha)	2,854	7,592	4,131	2,884	3,104	2,058	8,377	1,608	4,811	4,619	3,495	5,566	3,288	4,888	4,619
Net margin (R/ton)	540	1,148	812	827	511	416	1,168	361	1,140	699	659	912	671	1,137	733
2) BREAK-EVEN & PROFITABILITY															
Break-even yields (t/ha)	4,09	3,79	3,72	2,78	5,10	4,08	4,05	3,93	3,04	5,16	3,83	4,03	3,82	3,10	4,85
Break-even price (R/ton)	1,842	1,538	2,218	3,236	2,668	1,965	1,517	2,670	2,924	2,480	1,722	1,773	2,359	2,927	2,446
Profitability (%)	29%	75%	37%	26%	19%	21%	77%	14%	39%	28%	38%	51%	28%	39%	30%
3) EFFICIENCY RATIOS															
Cost ratio (total cost/ gross income)	77%	57%	73%	80%	84%	83%	56%	88%	72%	78%	72%	66%	78%	72%	77%
Net margin as % of Gross income	23%	43%	27%	20%	16%	17%	44%	12%	28%	22%	28%	34%	22%	28%	23%
Return on production capital	29%	75%	37%	26%	19%	21%	77%	14%	39%	28%	38%	51%	28%	39%	30%

Key observations for the NWFS

1. Yield

Figure 6.1 presents the average maize yield (t/ha) for all producers by farming practice per year, from 2019 to 2023, across three categories: Conventional Tillage (CT), CT to NT/CA (Transition Phase) (CT-NT/CA), and no-till/conservation agriculture (NT/CA). The highest recorded yield is 7.2 t/ha for the CT-NT/CA transition practice in 2020. Both CT and CT-NT/CA practices show significant variability in yield, with periods of both high and low performance while NT/CA shows a relatively stable performance across the years, maintaining more stable yield and not so much variability.

To account for variability in the data, the average yield for the periods 2019–2020 and 2022–2023 were calculated (**Figure 6.2**). These averages help in smoothing out fluctuations and provide a more stable basis for comparison. The trend derived from these averages is presented in **Figure 6.2**. NT/CA shows a significant increase in yield over time, indicating improved performance or adaptation of this practice.

During the 2019–2020 period, NT/CA yield were lower compared to both CT and the CT-NT/CA (transition phase-TP):

- Yields were 4% lower for NT/CA compared to CT.
- Yields were 6% lower for NT/CA compared to the CT-NT/CA transition phase.

However, this trend shifted significantly by the 2022–2023 period:

- Yields for NT/CA were now 11% higher than those for CT, showing a marked improvement in performance for NT/CA.
- Yields for NT/CA were only 2% lower compared to the CT-NT/CA transition phase, narrowing the yield gap considerably.

This indicates a substantial increase in the effectiveness of NT/CA over time in this region for the production costs evaluated, surpassing CT and almost matching the yields of the transition phase by

2022–2023. This shift highlights the potential for NT/CA to achieve comparable or even higher productivity as practices and adaptations improve.

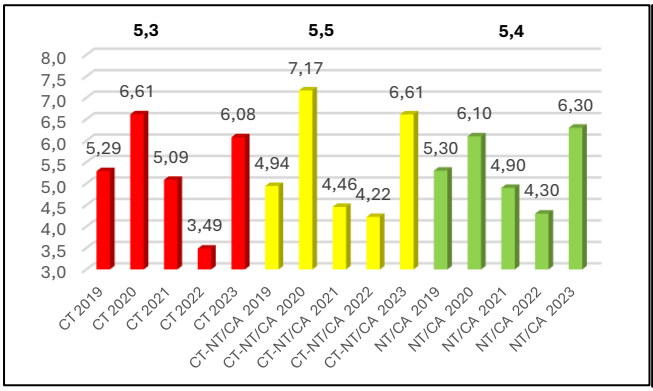


Figure 6.1 Yield: Average of all producers per practice per year (t/ha)

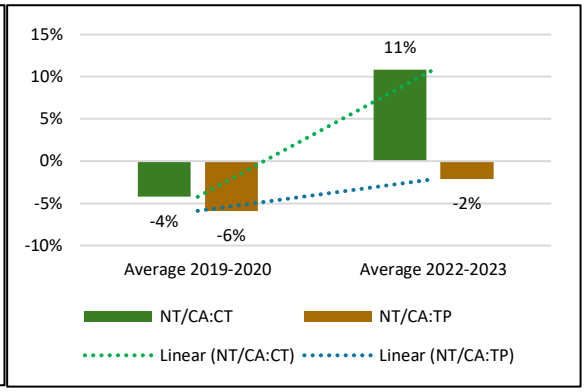


Figure 6.2 Ratio of yield per ton NT/CA to CT and NT/CA to TP (%)

2. Variable costs

Total variable costs per hectare for all three farming systems show a consistent increase in total variable costs from 2019 to 2023 (**Figure 6.3**). Rising input prices, especially fertilisers, chemicals (pest and weed control) and fuel, drive this upward trend. However, the rate and extent of increase vary slightly among the systems. CT showed a significant increase in 2023, reaching its highest value at R12 885/ha. Similarly, CT-NT/CA (the transition phase) saw a peak in 2023 at R12 994/ha and NT/CA also increased but remained lower overall, with its highest cost in 2023 at R12 030/ha.

To address variability in the total production cost data, averages for the 2019–2020 and 2022–2023 periods were calculated to smooth out fluctuations. These averages are illustrated in **Figure 6.4**, which compares the ratio of total variable costs (R/ha) for no-till/conservation agriculture (NT/CA) against Conventional Tillage (CT) and Transition Practice (TP) in the NWFS. During the 2019–2020 period, NT/CA costs were 2% higher than CT and 1% lower than TP. By the 2022–2023 period, NT/CA showed significant cost reductions, with total variable production costs being 4% lower than both CT and TP. The linear trend lines indicate a consistent decline in NT/CA's relative costs over time for the data received and analysed, highlighting its improved cost competitiveness in recent years. This trend may indicate that NT/CA could offer more sustainable cost advantages as time progresses, making it a more attractive option for producers seeking to reduce production costs while maintaining productivity.

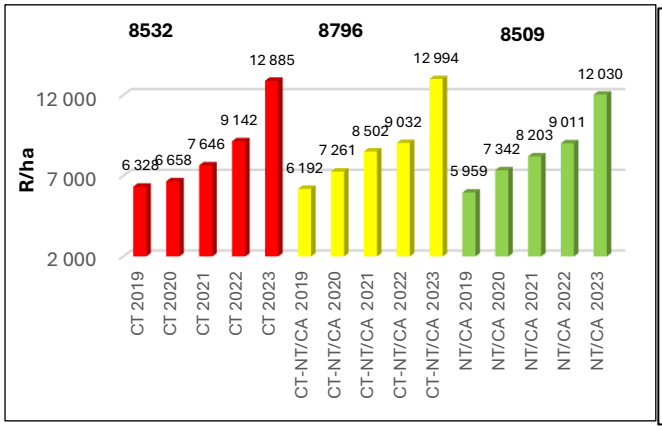


Figure 6.3 Total variable production cost: Average of all producers per practice per year (R/ha)

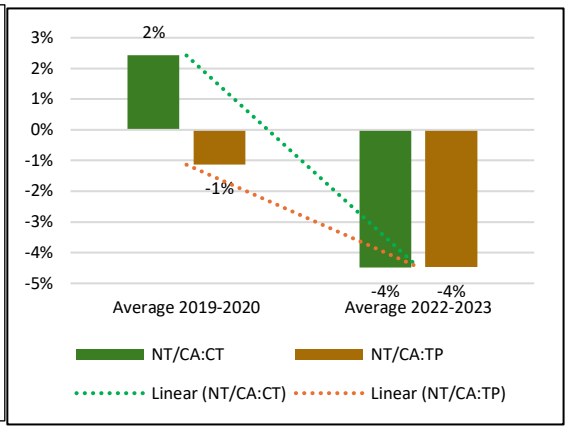


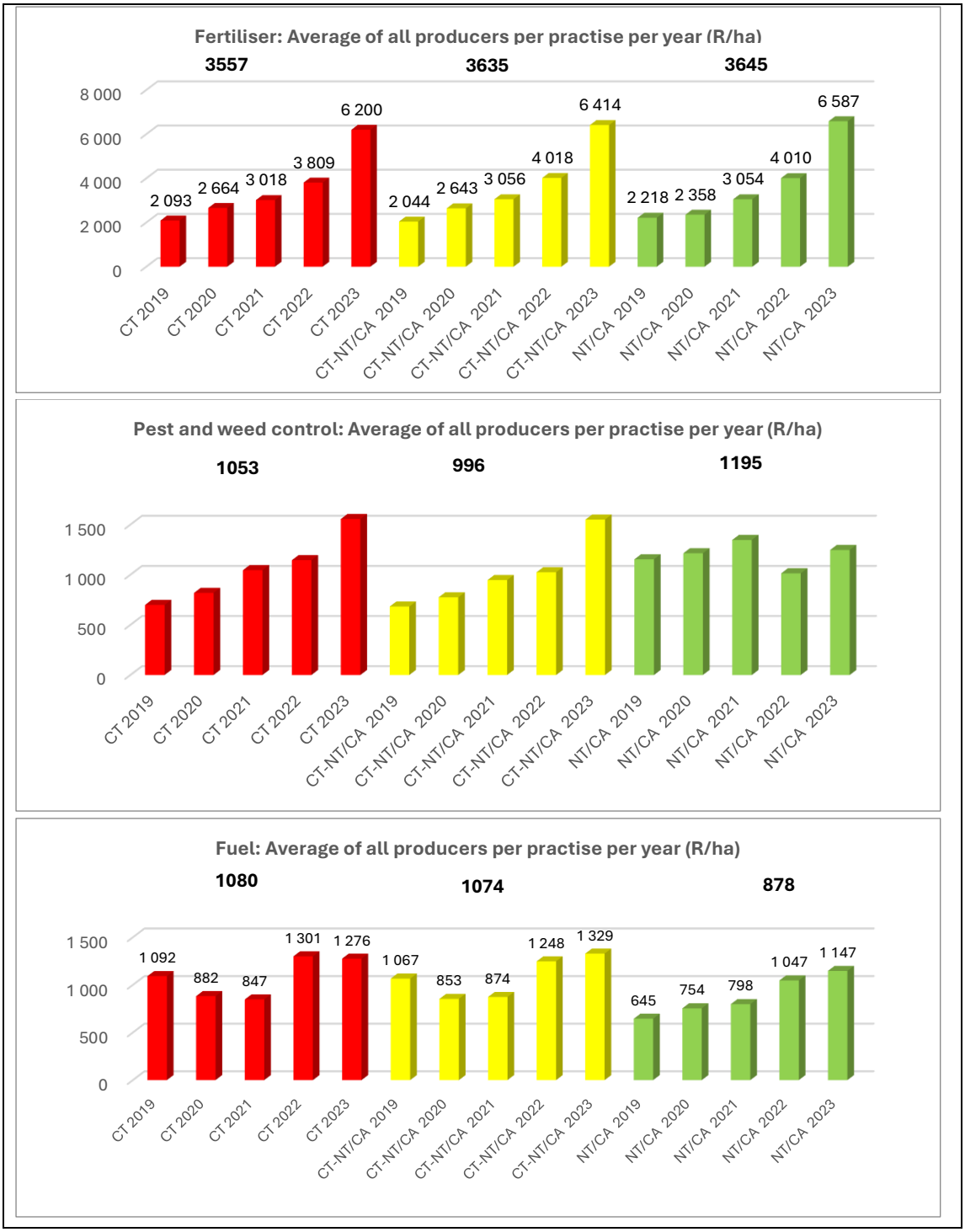
Figure 6.4 Ratio of total variable production cost per ha NT/CA to CT and NT/CA to TP (%)

% Share of each input to total variable cost

Based on the actual production cost data provided key observations regarding different variable production costs that stand out are the following:

1. Fertiliser is the most significant contributor to the total variable costs across all farming practices (CT, CT-NT/CA, NT/CA). A significant increase in fertiliser costs is observed from 2022 to 2023 for all systems. This increase is quite dramatic, with all systems showing a more than 60% increase. This increase was mainly attributed to external factors such as:
    - Global supply chain disruptions and shortages.
    - Rising costs of natural gas, a key component in fertiliser production.
    - Increased global demand for food production post-pandemic.
    - Geopolitical tensions affecting global fertiliser trade (e.g., export bans, tariffs).
2. Pest and weed control costs have consistently been a significant expense, especially in NT/CA systems where reduced tillage often requires more spraying to manage weeds and pests. When considering the 5-year average cost, the NT/CA systems' cost is the highest, indicating more frequent or intensive chemical application in these systems compared to the other 2 systems.
3. Fuel costs are higher in CT systems compared to NT/CA. The differences in fuel costs can primarily be attributed to the varying degrees of soil disturbance and tillage intensity required by each farming practice. Fuel costs are consistently lower in CA systems compared to CT and even during the transitional phase (CT to NT/CA). NT/CA practices rely on minimal soil disturbance avoiding tillage operations that are fuel-intensive.
4. Repair and maintenance costs are another variable cost that differs between farming practices due to the extent of machinery use. These costs are generally lower in NT/CA systems and can be attributed to the reduced wear and tear on equipment due to less intensive tillage operations. The reduction in fuel costs is closely linked with the lower

repair and maintenance costs observed in NT/CA practices. Less fuel consumption due to fewer machinery activities also means less mechanical impact on equipment, leading to reduced breakdowns and maintenance needs.



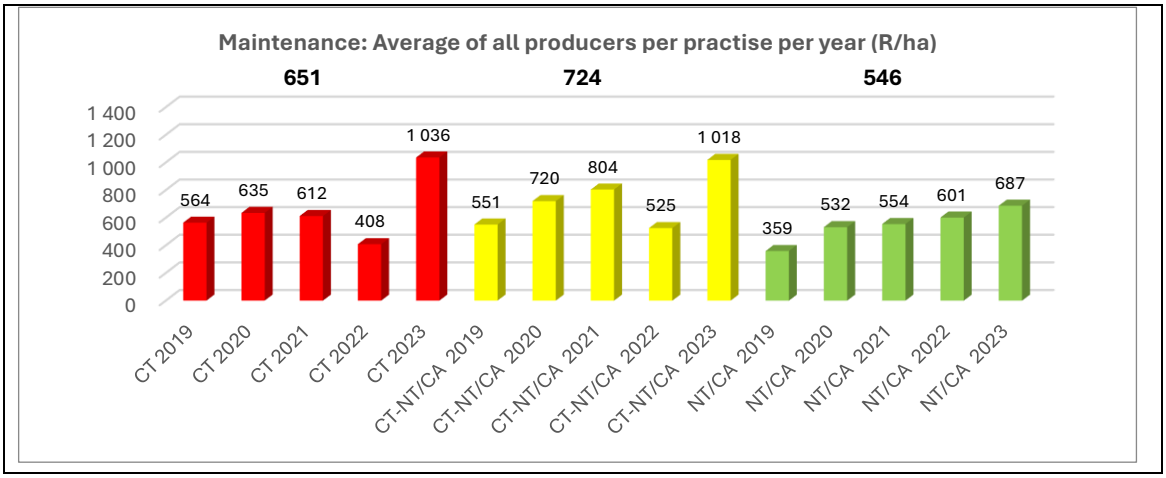


Figure 6.5 % Share of fertiliser, fuel, pest and weed control and maintenance to total variable cost for the NWFS

CT = Conventional Tillage; CT-NT/CA = Transition Phase; CA = No-till/Conservation Agriculture

3. Net Margin

Figure 6.6 shows the net margins for maize production in the Northwest Free State across the three different farming practices for the years 2019–2023.

Despite significant variability across all farming practices, the net margin peaked in 2020 for all systems, largely due to favourable production conditions that resulted in good yields. However, the trends in net margins reveal notable differences between the three practices:

- Conventional Tillage (CT): The net margin per hectare for conventional tillage producers peaked sharply in 2020 at R7 592 but saw a consistent decline in the following years, dropping to R3 104 by 2023. This system experienced the lowest net margins in the last two seasons compared to other practices, indicating possible inefficiencies or challenges in maintaining profitability.
- Conventional to no-till/conservation (CT-NT/CA) Producers: These producers experienced the most volatility, with a major spike in 2020 (R8 377) followed by a sharp drop to R1 608 in 2021. By 2023, the net margin recovered to R4 619, suggesting that transitioning producers face significant fluctuations in profitability, likely due to the complex process of adopting new conservation practices.
- No-till/conservation agriculture (NT/CA) producers: The data revealed that conservation producers demonstrated the most consistent margins throughout the period, with fewer extreme variations compared to conventional and transitioning producers. This consistency may point to conservation agriculture as a more sustainable approach to long-term profitability. The net margins peaked at R5 566 in 2020 and maintained a steady return, slightly dipping to R4 619 in 2023. This trend suggests that conservation practices might offer a more reliable profitability model in the long run, being less susceptible to extreme fluctuations in margins compared to the volatility experienced by conventional and transitioning producers.

To address variability in the margin data, averages for the 2019–2020 and 2022–2023 periods were calculated to smooth out fluctuations (**Figure 6.7**). No-till/conservation agriculture (NT/CA) has demonstrated a steady increase in profitability, surpassing CT in the 2022–2023 period and nearly matching the profitability of Transitioning Practices (TP). During 2019–2020, NT/CA margins were 13% lower than both CT and TP. However, by 2022–2023, NT/CA margins had improved significantly, being 59% higher than CT and nearly equal to TP margins, with only a 1% difference. The improvement in NT/CA margins can be attributed to the long-term benefits of conservation practices, which enhance soil health, water retention, and input efficiency over time.

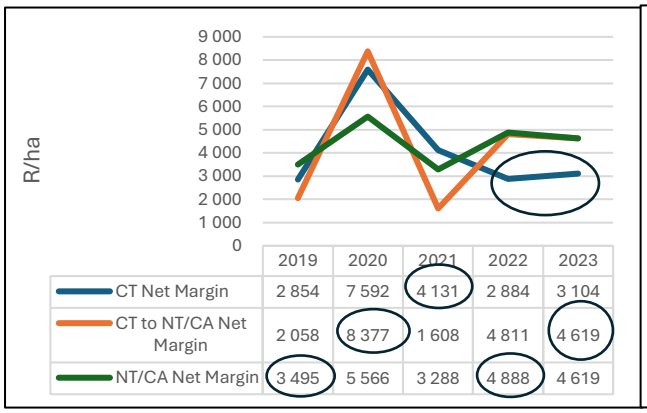


Figure 6.6 Net Margin for the different production practices per year (R/ha)

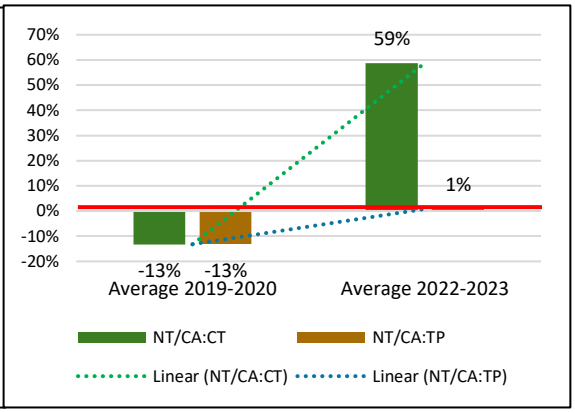
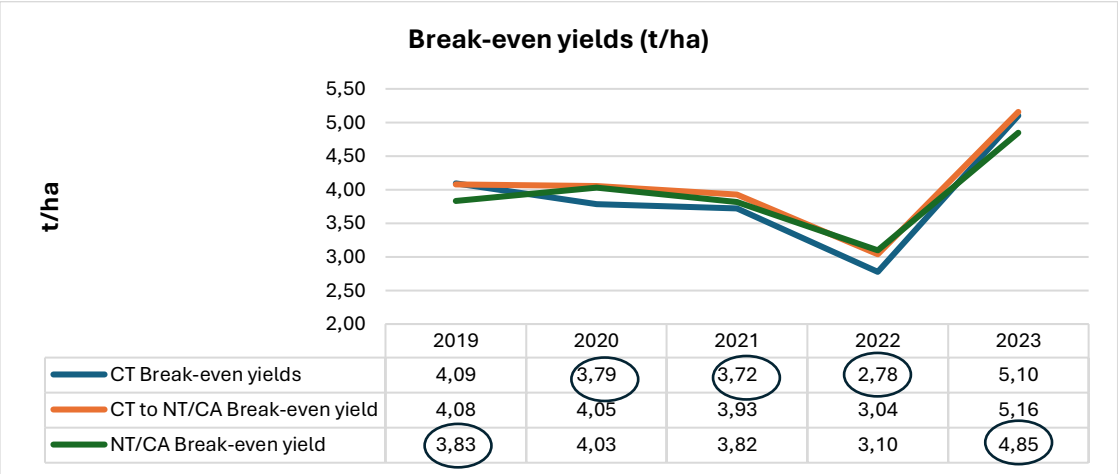


Figure 6.7 Ratio of net margin per ha NT/CA to CT and NT/CA to TP (%)

4. Break-even calculation & Profitability

- Break-even Yield (t/ha): The break-even yield (t/ha) is the amount of maize that a producer needs to produce to cover all production costs (variable + overhead costs) without making a profit or incurring a loss. It is calculated by dividing the total production costs per hectare by the price per ton of maize.

  All three practices (conventional, conventional to no-till/conservation, and no-till/conservation agriculture) present a similar trend in break-even yields, with a general pattern of decline up to 2022 followed by an increase in 2023. This trend suggests that all practices face similar challenges in managing production costs and yield variability over time. While conservation practices tend to be more stable, they still experience fluctuations in break-even yields, reflecting broader industry trends and external factors impacting maize production.



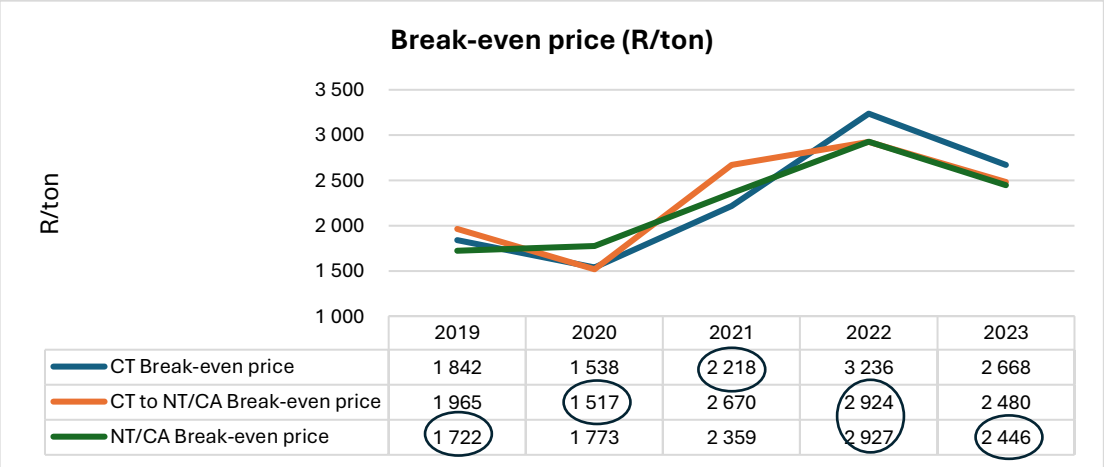
	2019	2020	2021	2022	2023
CT Break-even yields	4,09	3,79	3,72	2,78	5,10
CT to NT/CA Break-even yield	4,08	4,05	3,93	3,04	5,16
NT/CA Break-even yield	3,83	4,03	3,82	3,10	4,85

Figure 6.8 Break-even yields for the different production practices per year for the NWFS (t/ha)

*The lower the break-even the better

- Break-Even Price (R/t): The break-even price (R/ton) is the price per ton of maize at which total income equals total production costs, resulting in neither profit nor loss. It is calculated by dividing the total production costs (variable + overhead costs) per hectare by the average yield.

  The same as with the break-even yields, all three farming practices show a similar trend in break-even prices, characterised by a significant increase up to 2022, followed by a decrease in 2023. This common pattern suggests that all practices are affected by rising production costs over time, but also show signs of adjustment or efficiency improvements in the most recent period. While no-till/conservation producers maintain the lowest break-even prices overall, reflecting better cost management, the overall trend of increasing costs is evident across all practices.

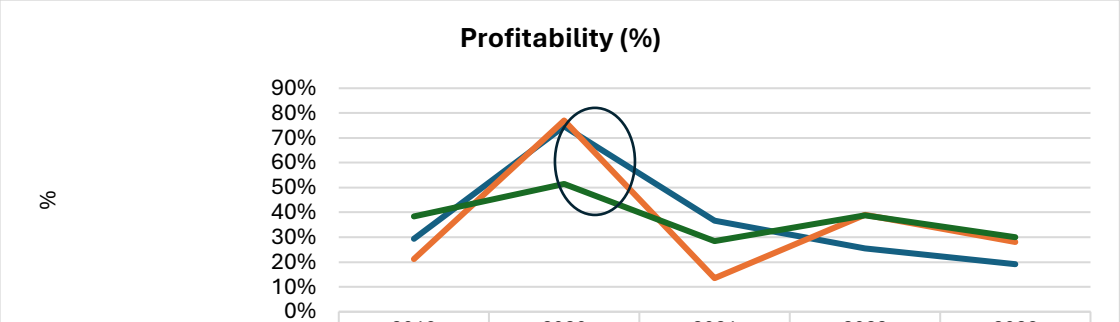


	2019	2020	2021	2022	2023
CT Break-even price	1 842	1 538	2 218	3 236	2 668
CT to NT/CA Break-even price	1 965	1 517	2 670	2 924	2 480
NT/CA Break-even price	1 722	1 773	2 359	2 927	2 446

Figure 6.9 Break-even price for the different production practices per year for the NWFS (R/ton)

*The lower the break-even the better

- Profitability (%): It is a measure of financial performance, indicating the percentage of profit relative to the income. It is calculated by subtracting the break-even price from the producer price, dividing it by the producer price, and then multiplying by 100 to express it as a percentage.
  From **Figure 6.10** it is clear that profitability across all farming practices shows a general trend of fluctuating performance, with a peak around 2020 followed by a decrease towards 2023. Conventional and transitioning producers experience higher variability, with profitability reflecting significantly in contrast with NT/CA showing more stable profitability, indicating a more reliable financial performance. Overall, while all practices face variability, NT/CA practices generally offer more consistent and stable profitability.



	2019	2020	2021	2022	2023
CT Profitability	29%	75%	37%	26%	19%
CT to NT/CA Profitability	21%	77%	14%	39%	28%
NT/CA Profitability	38%	51%	28%	39%	30%

Figure 6.10 Profitability for the different production practices per year for the NWFS (%)

*The higher the % the better

5. Efficiency ratios

Efficiency ratios provide critical insights into the financial performance and cost management effectiveness of different maize production practices. They measure how well production costs are managed relative to gross income and how net margins compare to overall income. In the context of maize production in the Northwest Free State, the following efficiency ratios are considered:

- Cost Ratio (Total Cost/Gross Income): The Cost Ratio measures the proportion of total production costs relative to gross income (**Figure 6.11**). It reflects how efficiently costs are managed to the income generated from maize production. *Higher Cost Ratio (%):* This indicates that a larger share of gross income is consumed by production costs. This can lead to reduced profitability as less of the income remains as profit. *Lower Cost Ratio (%):* This signifies more efficient cost management, with a smaller percentage of gross income being spent on production costs. This typically results in higher profitability, as more of the income contributes to net profit.

- Conventional Tillage (CT): The cost ratio for conventional producers starts at 77% in 2019, decreases to 57% in 2020, and then consistently increases to 84% in 2023. These year-on-year increases indicate rising costs and thus less effective cost management, leading to a higher proportion of gross income being consumed by production costs.
- Conventional to no-till/conservation (CT-NT/CA): The cost ratio fluctuates from 83% in 2019, drops to 56% in 2020, peaks at 88% in 2021, and then decreases slightly to 78% in 2023. Similar to conventional tillage producers, the CT-NT/CA producers experienced a notable decrease in cost ratio in 2020, reflecting improved cost efficiency. However, the subsequent peak in 2021 and the decrease in 2023 suggest variability in cost management during the transition period and increased production costs.
- No-till/conservation Producers (NT/CA): The cost ratio remains relatively stable, starting at 72% in 2019, decreasing to 66% in 2020, and then fluctuating between 72% and 78% in the following years. No-till/conservation producers show consistent cost efficiency with fewer dramatic fluctuations. This stability indicates effective management of production costs, maintaining a relatively lower proportion of gross income spent on costs compared to conventional and transitioning practices.

In summary, the no-till/conservation producers exhibit the highest cost efficiency with a final 5-year average cost ratio of 73%, indicating the most effective management of production costs and the best protection of gross income as profit. Conventional tillage producers follow closely with an average cost ratio of 74%, reflecting reasonably good cost management but slightly less efficient than no-till/conservation producers and Conventional to no-till/conservation producers with a higher average cost ratio of 75%, face the greatest cost pressures, suggesting less effective cost control compared to the other practices. Overall, no-till/conservation practices demonstrate the best cost efficiency among the three.

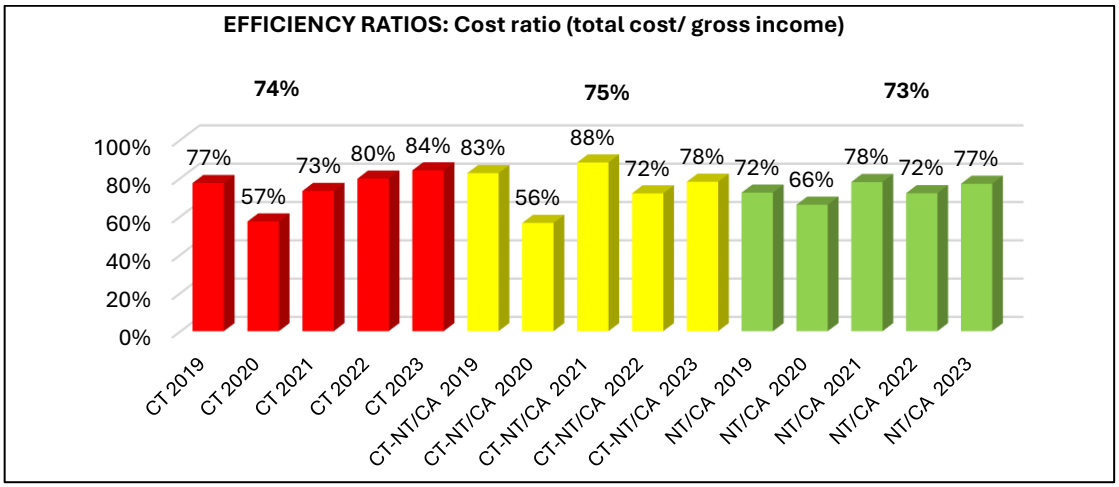


Figure 6.11 Efficiency ratios: Cost ratio

- Net Margin as % of Gross Income: The Net Margin as a percentage of gross income measures the proportion of net profit relative to gross income, providing insight into the overall profitability of the production practices. *Higher Net Margin %:* Reflects greater

profitability, indicating that a larger portion of gross income is retained as profit after all costs have been covered. *Lower Net Margin %:* Indicates lower profitability, with a smaller share of gross income remaining as profit. This may point to higher costs or less effective revenue.

No-till/conservation producers achieve the highest year average net margin at 27%, indicating the most effective profitability relative to gross income. Conventional tillage producers follow with an average net margin of 26%, reflecting strong profitability but slightly lower than no-till/conservation producers. Conventional to no-till/conservation producers have the lowest final average net margin at 25%, suggesting somewhat less effective profitability compared to the other practices. Overall, higher net margin percentages indicate better profitability, with no-till/conservation practices leading in performance.

No-till/conservation practices excel in both cost efficiency and profitability, showing the most effective management of production costs and the highest net margins. Conventional practices face greater cost pressures and slightly lower profitability, while Conventional to no-till/conservation practices, despite improvements in cost efficiency, struggle with lower profitability during the transition period.

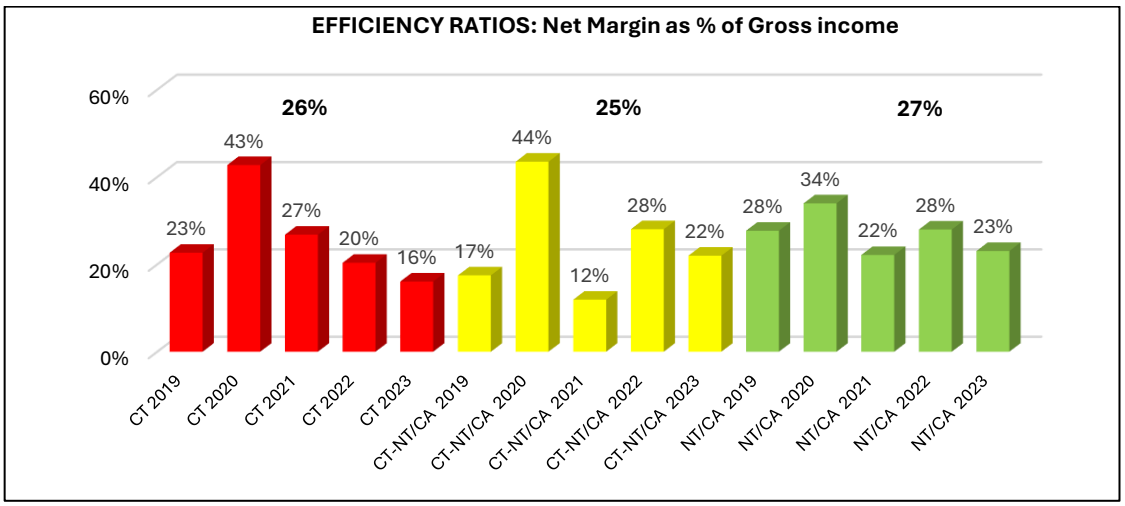


Figure 6.12 Net Margin as % of Gross Income

6.2 Data analysis per region: North West Province (NW):

Note: In contrast to the North West Free State (NWFS) region, the tables and graphs for this region will not be discussed in such detail.

Table 5 below shows detailed actual production costs while Table 6 shows the comparison of various metrics and efficiency ratios across different categories of maize producers (Conventional Tillage (CT), CT to NT/CA transition, and no-till/conservation agriculture (NT/CA).

Table 5 Summary of combined actual production cost for each production practice of the NWFS (5-year period)

Summary calculations: North West production area: Average of all producers per year as per production practise

	Conventional Farmer (CT)					Conventional to Conservation (Transitional phase - TP)					No-till/Conservation Farmers (NT/CA)				
	Average of all CT Farmers					Average of all CT to NT/CA Farmers					Average of all NT/CA Farmers				
	CT 2019	CT 2020	CT 2021	CT 2022	CT 2023	CT-NT/CA 2019	CT-NT/CA 2020	CT-NT/CA 2021	CT-NT/CA 2022	CT-NT/CA 2023	NT/CA 2019	NT/CA 2020	NT/CA 2021	NT/CA 2022	NT/CA 2023
Year	**2019**	**2020**	**2021**	**2022**	**2023**	**2019**	**2020**	**2021**	**2022**	**2023**	**2019**	**2020**	**2021**	**2022**	**2023**
Yield (t/ha)	1,8	5,0	5,3	5,4	5,9	3,4	6,0	5,8	6,3	6,1	2,3	5,2	5,9	7,2	6,8
Average Producer Price (R/ton)	2,382	2,686	3,030	4,064	3,179	2,382	2,686	3,030	4,064	3,179	2,382	2,686	3,030	4,064	3,179
Gross Farm income (GFI)	**4,199**	**13,407**	**16,128**	**21,741**	**18,725**	**8,149**	**16,168**	**17,566**	**25,595**	**19,298**	**5,477**	**13,992**	**17,819**	**29,116**	**21,640**
Direct variable cost															
Seed	937	989	1,187	1,248	1,371	921	872	972	1,287	1,470	1,145	1,147	1,352	1,671	1,527
Fertiliser	1,233	1,237	1,501	2,409	4,156	1,618	1,859	2,252	2,975	5,414	1,689	1,759	2,077	3,393	5,953
Lime	0	0	116	105	258	91	31	207	93	240	0	243	542	50	295
Chemical cost	471	644	869	768	1,300	630	866	767	1,039	1,486	948	1,096	990	1,127	1,765
Insurance (hail)	0	20	0	50	0	0	0	0	0	0	0	65	57	104	0
Marketing cost	15	177	62	53	317	113	100	99	167	715	60	23	6	4	429
Contract work	1	110	78	59	83	51	60	126	108	137	0	212	448	278	603
Labour	191	292	306	332	279	207	280	265	240	217	0	110	91	2	133
Diverse expenses	0	25	23	0	4	14	23	44	50	69	20	56	48	64	337
Fuel	830	1,017	1,110	1,469	1,665	656	740	833	1,081	1,170	394	364	525	588	685
Repair and maintenance	486	690	743	968	1,246	474	466	661	705	955	366	274	432	323	656
Transport cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total variable cost	**4,163**	**5,203**	**5,996**	**7,462**	**10,679**	**4,773**	**5,297**	**6,226**	**7,746**	**11,873**	**4,622**	**5,348**	**6,568**	**7,604**	**12,383**
Total overhead cost	**1,330**	**2,295**	**4,425**	**3,631**	**3,871**	**1,194**	**1,666**	**3,542**	**4,946**	**3,933**	**1,571**	**2,261**	**6,278**	**4,763**	**4,160**
Total cost	**5,492**	**7,498**	**10,421**	**11,093**	**14,551**	**5,967**	**6,963**	**9,768**	**12,692**	**15,806**	**6,193**	**7,609**	**12,845**	**12,367**	**16,542**
Farming profit/loss	**-1,293**	**5,909**	**5,707**	**10,648**	**4,175**	**2,182**	**9,205**	**7,798**	**12,903**	**3,492**	**-715**	**6,383**	**4,973**	**16,749**	**5,097**

Table 6 Summary of margin, break-even calculations and efficiency ratios for each production practice of the NW (5-year period)

North West production area: Average of all producers per year as per production practise

	Conventional Farmer					Conventional to No-till/Conservation					No-till/Conservation Farmers (NT/CA)				
SUMMARY	Average of all CT Farmers					Average of all CT to NT/CA Farmers					Average of all NT/CA Farmers				
	CT 2019	CT 2020	CT 2021	CT 2022	CT 2023	CT-NT/CA 2019	CT-NT/CA 2020	CT-NT/CA 2021	CT-NT/CA 2022	CT-NT/CA 2023	NT/CA 2019	NT/CA 2020	NT/CA 2021	NT/CA 2022	NT/CA 2023
1) INCOME	**2019**	**2020**	**2021**	**2022**	**2023**	**2019**	**2020**	**2021**	**2022**	**2023**	**2019**	**2020**	**2021**	**2022**	**2023**
1) NETT MARGIN															
Nett margin (R/ha)	-1,293	5,909	5,707	10,648	4,175	2,182	9,205	7,798	12,903	3,492	-715	6,383	4,973	16,749	5,097
Net margin (R/ton)	-733	1,184	1,072	1,990	709	638	1,529	1,345	2,049	575	-311	1,225	846	2,338	749
2) BREAK-EVEN & PROFITABILITY															
Break-even yields (t/ha)	2,31	2,79	3,44	2,73	4,58	2,51	2,59	3,22	3,12	4,97	2,60	2,83	4,24	3,04	5,20
Break-even price (R/ton)	3,115	1,502	1,958	2,073	2,470	1,744	1,157	1,685	2,015	2,604	2,693	1,460	2,185	1,726	2,430
Profitability (%)	-24%	79%	55%	96%	29%	37%	132%	80%	102%	22%	-12%	84%	39%	135%	31%
3) EFFICIENCY RATIOS															
Cost ratio (total cost/ gross income	131%	56%	65%	51%	78%	73%	43%	56%	50%	82%	113%	54%	72%	42%	76%
Net margin as % of Gross income	-31%	44%	35%	49%	22%	27%	57%	44%	50%	18%	-13%	46%	28%	58%	24%
Return on production capital	-24%	79%	55%	96%	29%	37%	132%	80%	102%	22%	-12%	84%	39%	135%	31%

Key observations for the North West province

1. Yields

Figure 6.13 presents the average maize yield (t/ha) for all producers by farming practice per year, from 2019 to 2023, across the three categories: Conventional Tillage (CT), CT to NT/CA (Transition Phase) (CT-NT/CA), and no-till/conservation agriculture (NT/CA). The highest recorded yield is 7.2 t/ha for the NT/CA transition practice in 2022. CT yields improved steadily over time, starting low in 2019 and reaching higher, more stable levels by 2023. The CT-NT/CA yields were more consistent, showing moderate increases each year while NT/CA yields showed the most significant growth, reflecting the potential long-term benefits of conservation practices.

Figure 6.14 displays the ratio of maize yields between No-till/Conservation Agriculture (NT/CA) and Conventional Tillage (CT), as well as between NT/CA and Transitioning Practices (TP), for the North West over two time periods: 2019–2020 and 2022–2023. During 2019–2020, NT/CA yields were 11% higher than the CT yields while during 2022–2023, this yield advantage increased to 24%, showing a significant improvement in NT/CA relative to CT over time. In 2019–2020, NT/CA yields were 20% lower than TP yields. However, this trend completely reversed in 2022–2023, when NT/CA yields were, on average, 13% higher than TP yields.

Over the five years, NT/CA practices demonstrated an upward trend in yield performance compared to both CT and the transitioning phase (TP). The improvements were more pronounced against CT, while the yield gap with TP also decreased, indicating the growing effectiveness of NT/CA practices.

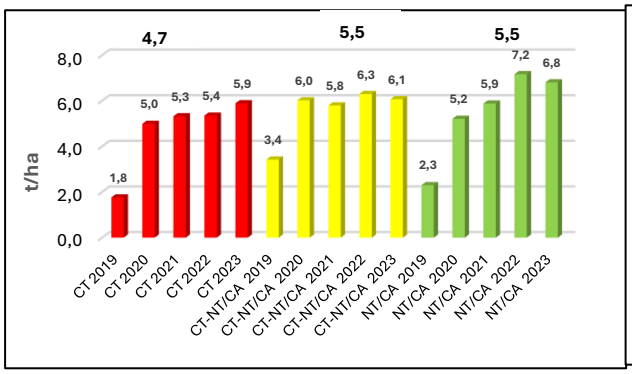


Figure 6.13 Yield: Average of all producers per practice per year (t/ha)

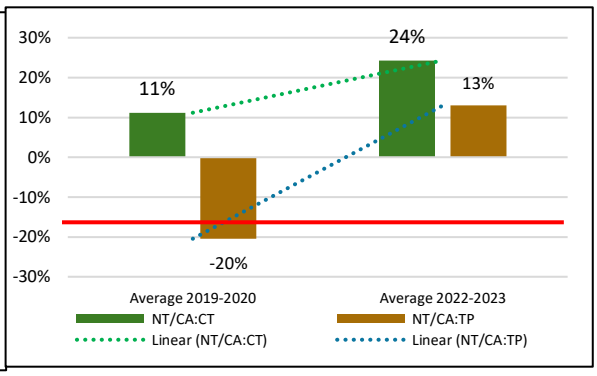


Figure 6.14 Ratio of yield per ton NT/CA to CT and NT/CA to TP

2. Variable Costs

The same as for the NWFS region, the total variable costs per hectare for all three farming systems in the NW show a consistent increase from 2019 to 2023 (**Figure 6.15**). To account for variability in the total production cost data, averages for 2019–2020 and 2022–2023 were calculated for the total variable cost to mitigate fluctuations. These averages are shown in **Figure 6.16**, which compares the ratio of total variable costs (R/ha) for no-till/conservation agriculture (NT/CA) with those of Conventional Tillage (CT) and Transition Practice (TP) in the NW. In the 2019–2020 period, NT/CA variable production costs were 6% higher than that of CT and increased to 10% higher during the 2022–2023 period. Furthermore, the production costs for NT/CA and TP were relatively similar in both periods, indicating a consistent cost relationship between these two practices over time. This trend contrasts sharply with what was observed in the NWFS, where, by the 2022–2023 period, NT/CA were substantially lower, resulting in total variable production costs that were lower than both CT and TP.

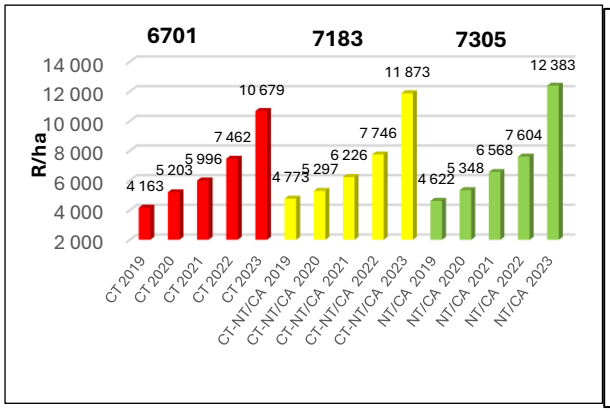


Figure 6.15 Total variable production cost: Average of all producers per practice per year (R/ha)

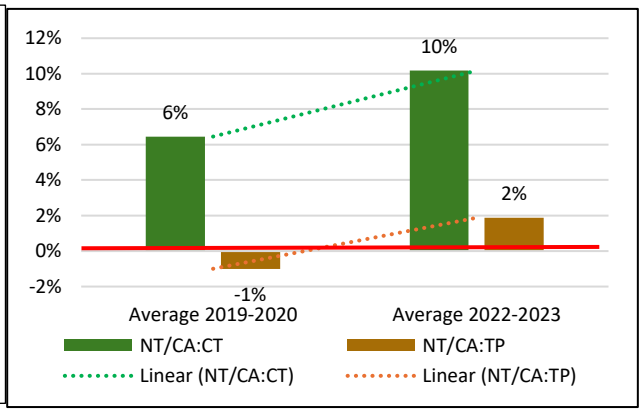


Figure 6.16 Ratio of total variable production cost per ha NT/CA to CT and NT/CA to TP

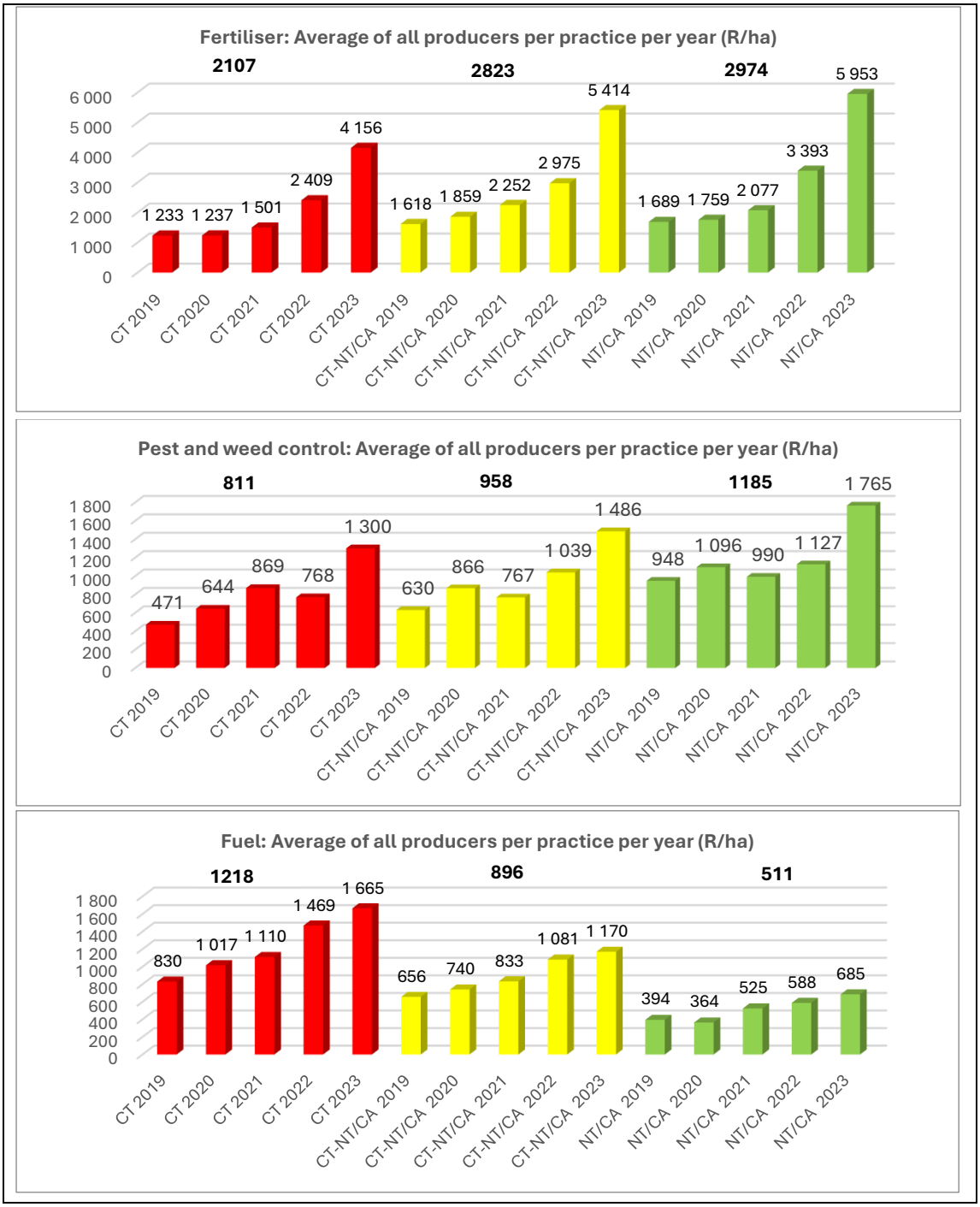
% Share of each input to total variable cost

Based on the actual production cost data for the NW, the following observations are made for the main contributing input costs:

1. Fertiliser remains the biggest contributor to the total variable costs across all farming practice. A significant increase in fertiliser costs was observed across all systems from 2022 to 2023, with increases ranging from 73% for CT, 75% for NT/CA to 82% for the Transition Phase. This dramatic increase is even higher than what was experienced in the NWFS.
2. Pest and weed control costs also increased significantly from 2022 to 2023 (ranging from 43% to 69%). When considering the 5-year average cost, the NT/CA systems' cost is the

highest, indicating more frequent or intensive chemical application in these systems compared to the other 2 systems.

3. Fuel costs are higher in CT systems compared to TP and NT/CA. This trend mirrors what is observed in the NWFS and was anticipated due to the more tillage activities associated with CT practices.
4. Repair and maintenance costs vary between farming practices due to differences in machinery use. Repair and maintenance costs are lowest for NT/CA and highest for CT, which correlates with the differences in fuel costs.



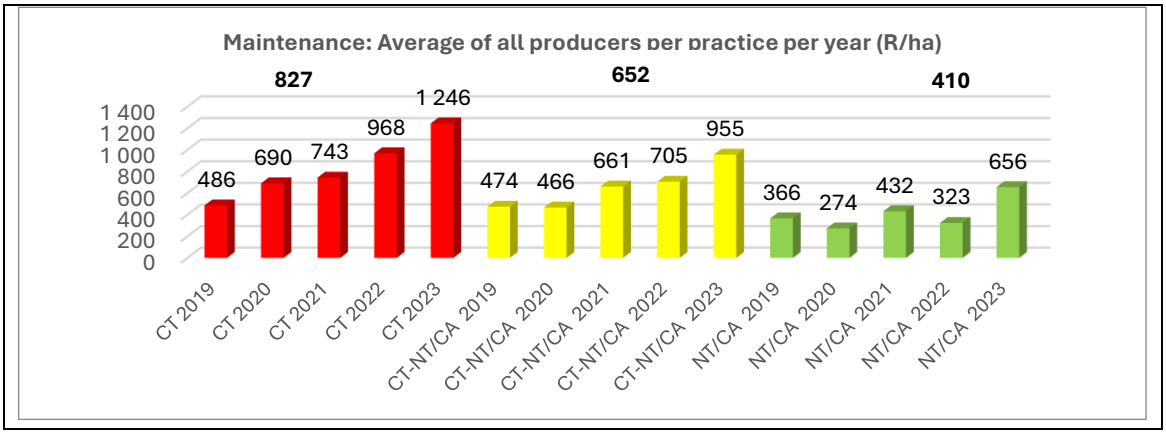


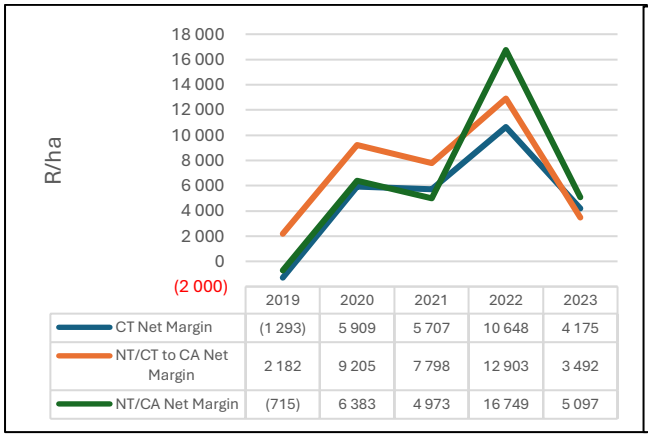
Figure 6.17 % Share of fertiliser, fuel, pest and weed control and maintenance to total variable cost for the NW

CT = Conventional Tillage; CT-NT/CA = Transition Phase (TP); NT/CA = no-till/conservation agriculture

3. Net Margin

Figure 6.18 shows the net margins for maize production in the North West across the three different farming practices for the years 2019–2023. While the net margins for all three practices followed a similar trend, significant differences are observed in Rand terms (**see Figure 6.18**). They peaked in 2022, largely due to favourable production conditions and the good prices achieved during that year. In contrast, the net margins in the Northwest Free State peaked in 2020.

To address variability in the margin data, averages for the 2019–2020 and 2022–2023 periods were calculated to smooth out fluctuations (**Figure 6.19**). During 2019–2020, NT/CA margins were 23% higher than CT while it was 50% lower than for the TP practice. However, by 2022–2023, NT/CA margins had improved significantly, being 47% higher than CT and 33% higher than TP. The improvement in NT/CA margins can be attributed to the long-term benefits of conservation practices.



	2019	2020	2021	2022	2023
CT Net Margin	(1 293)	5 909	5 707	10 648	4 175
NT/CT to CA Net Margin	2 182	9 205	7 798	12 903	3 492
NT/CA Net Margin	(715)	6 383	4 973	16 749	5 097

Figure 6.18 Net Margin for the different production practices per year (R/ha)

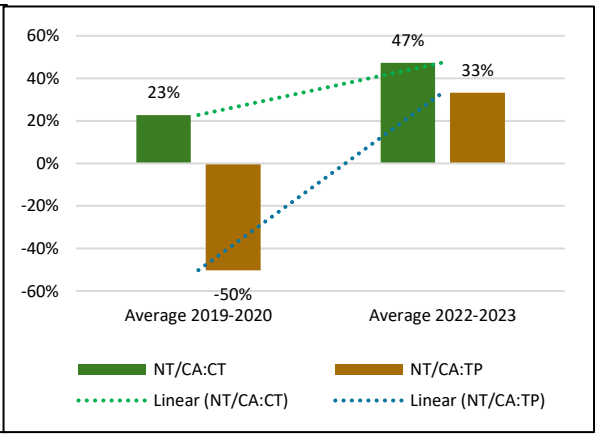


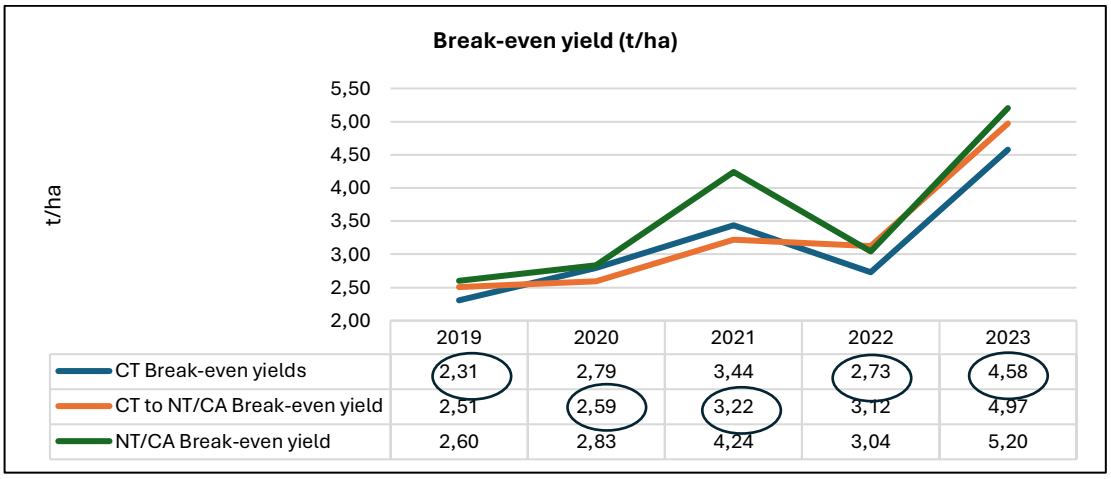
Figure 6.19 Ratio of net margin per ha NT/CA to CT and NT/CA to TP (%)

CT = Conventional Tillage; CT-NT/CA = Transition Phase; CA = no-till/conservation agriculture

4. Break-even calculations & Profitability

- Break-even Yield (t/ha): The break-even yield (t/ha) is the amount of maize that a farmer needs to produce to cover all production costs (variable + overhead costs). The data reveals a noticeable increase in break-even yields across all three farming practices – especially during the 2023 season. This trend highlights several critical factors and challenges that maize producers face in their efforts to remain profitable:
  - As input costs (such as seeds, fertilisers, pesticides etc.) increase, producers need to produce higher yields to cover these expenses. The increase in break-even yields reflects the escalating costs associated with maize production.
  - Economic Pressures: Market and input fluctuations make it increasingly difficult for producers to maintain profitability without achieving greater yields.

  As indicated in **Figure 6.15**, the actual production costs obtained for the NT/CA practices were the highest among the farming methods analysed. The elevated production costs for NT/CA directly necessitate higher break-even yields to ensure that producers can cover their expenses (**see Figure 6.20**).

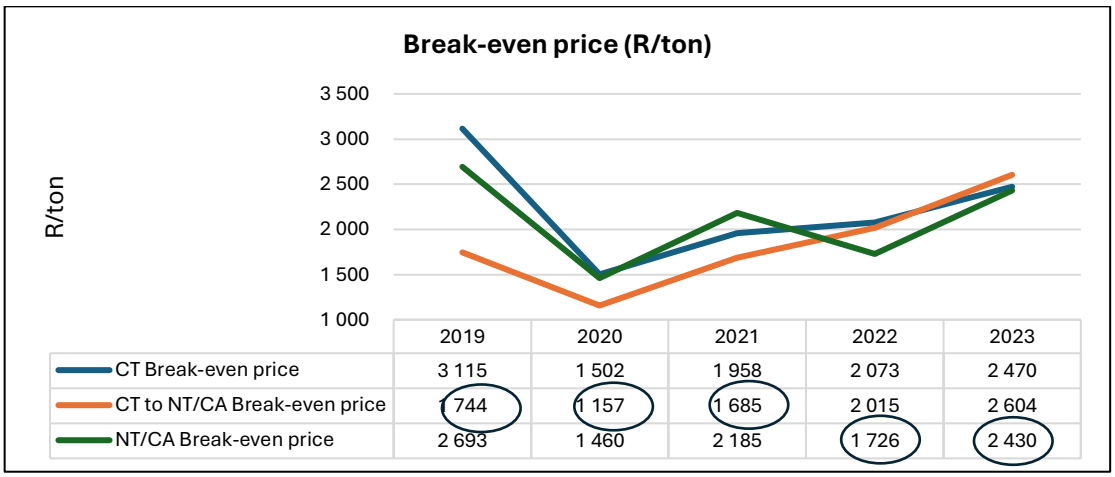


	2019	2020	2021	2022	2023
CT Break-even yields	2,31	2,79	3,44	2,73	4,58
CT to NT/CA Break-even yield	2,51	2,59	3,22	3,12	4,97
NT/CA Break-even yield	2,60	2,83	4,24	3,04	5,20

Figure 6.20 Break-even yields for the different production practices per year for the NW (t/ha)

*The lower the break-even the better

- Break-Even Price (R/t): The break-even price (R/ton) is the price per ton of maize at which total income equals total production costs (variable + overhead costs). The break-even prices for all practices show significant volatility, particularly in the early years (2019-2020). From **Figure 6.21**, it is clear that CT generally maintained higher break-even prices compared to TP and NT/CA producers in the early years, but this trend reversed for the 2023 year. The significant fluctuation in break-even prices for No-till/Conservation Agriculture (NT/CA), particularly the substantial drop in 2020, highlights a more volatile cost structure. This volatility may be attributed to the adoption of new practices and the initial inefficiencies associated with transitioning to conservation methods.

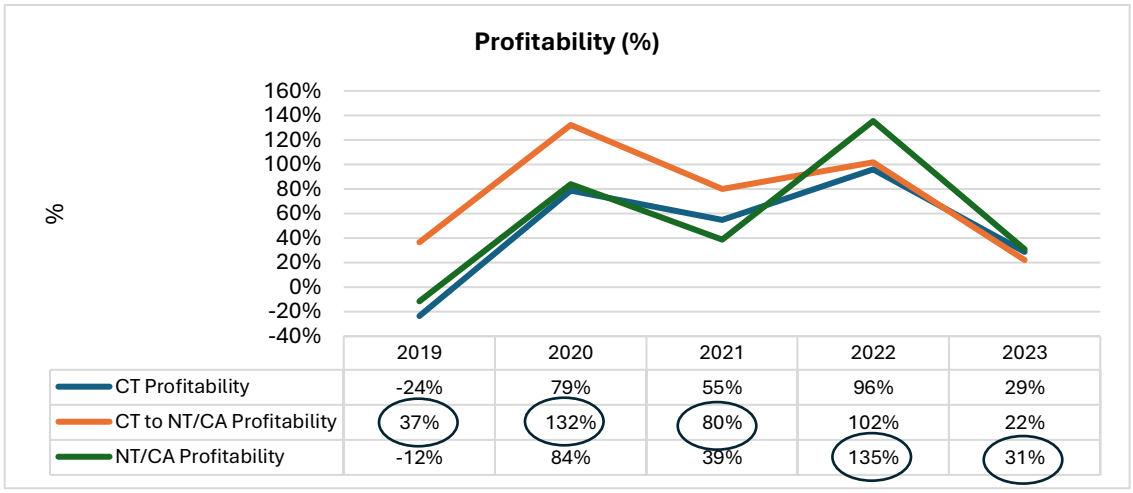


	2019	2020	2021	2022	2023
CT Break-even price	3 115	1 502	1 958	2 073	2 470
CT to NT/CA Break-even price	1 744	1 157	1 685	2 015	2 604
NT/CA Break-even price	2 693	1 460	2 185	1 726	2 430

Figure 6.21 Break-even price for the different production practices per year for the NW (R/ton)

*The lower the break-even the better

- Profitability (%): It is a measure of financial performance, indicating the percentage of profit relative to the income. Overall, all farming practices exhibit variability in profitability, and there is a lack of consistency across the years. The practice with the highest profitability can be seen in **Figure 6.22**.



	2019	2020	2021	2022	2023
CT Profitability	-24%	79%	55%	96%	29%
CT to NT/CA Profitability	37%	132%	80%	102%	22%
NT/CA Profitability	-12%	84%	39%	135%	31%

Figure 6.22 Profitability for the different production practices per year for the NW (%)

*The higher the % the better

5. Efficiency ratios

- Cost Ratio (Total Cost/Gross Income): The Cost Ratio measures the proportion of total production costs relative to gross income. It reflects how efficiently costs are managed to the income generated from maize production. *Higher Cost Ratio (%)* lead to reduced profitability while a *Lower Cost Ratio (%)* typically results in higher profitability.

The cost ratios across all practices display significant variability. CT shows a pattern of fluctuating costs, while CT-NT/CA producers have generally improved their cost ratios over time. In contrast, NT/CA producers demonstrated both improvement and setbacks, reflecting the potential challenges of adopting new practices.

In summary, CT has the highest average cost ratio of 76%, indicating that it faces the greatest cost pressures, suggesting less effective cost control compared to the other practices. TP shows the highest cost efficiency with a final 5-year average cost ratio of 61%, indicating the most effective management of production costs and the best protection of gross income as profit. Overall, TP practices demonstrate the best cost efficiency among the three.

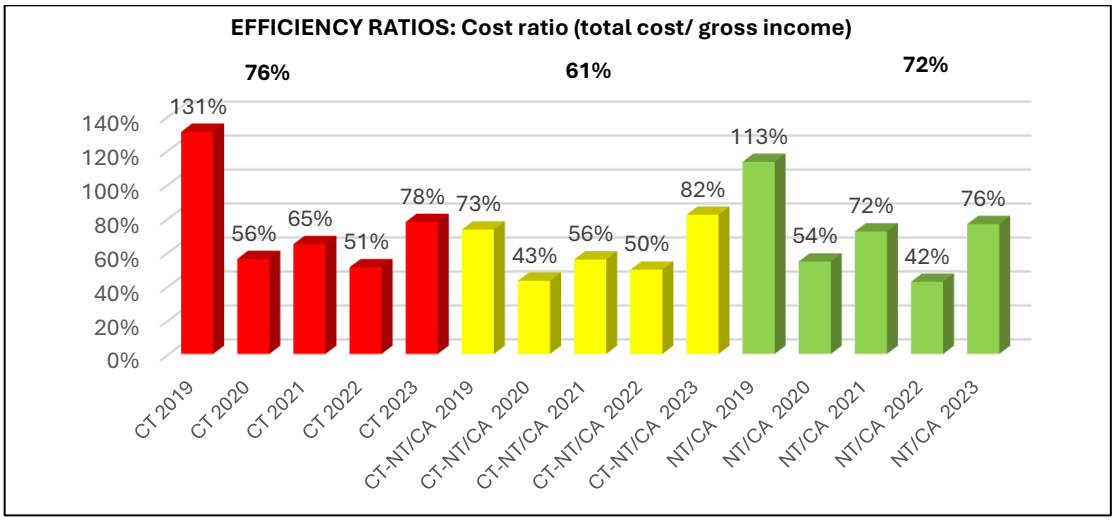


Figure 6.23 Efficiency ratios: Cost ratio

- Net Margin as % of Gross Income: The Net Margin as a percentage of gross income measures the proportion of net profit relative to gross income, providing insight into the overall profitability of the production practices. *A higher Net Margin %* reflects greater profitability while a *lower Net Margin % indicates* lower profitability.

  TP achieved the highest year average net margin at 39%, indicating the most effective profitability relative to gross income. NT/CA producers follow with an average net margin of 28%, reflecting strong profitability but slightly lower than TP producers. CT producers have the lowest final average net margin at 24%, suggesting somewhat less effective profitability compared to the other practices.

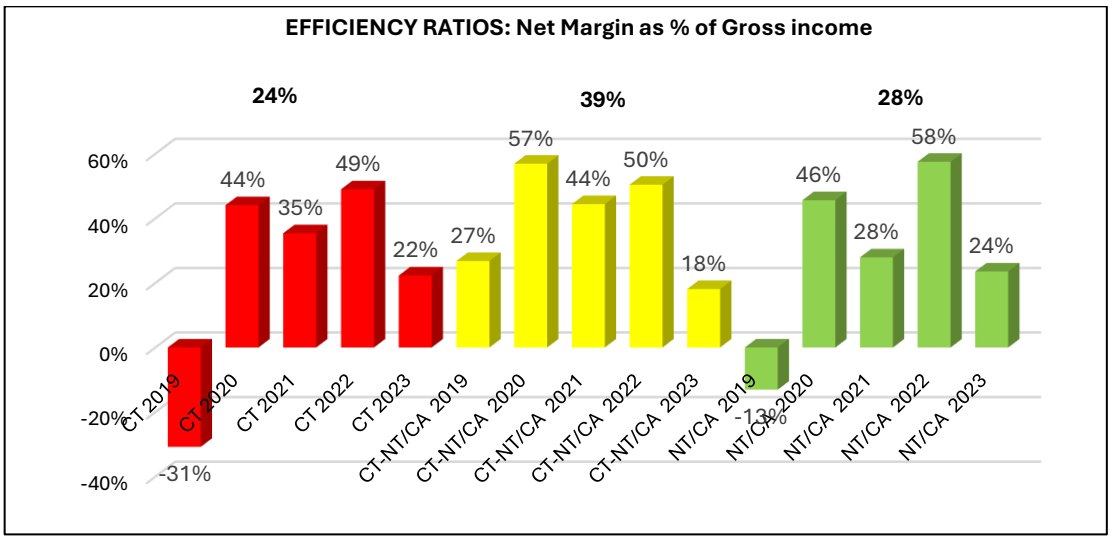


Figure 6.24 Net Margin as % of Gross Income

6.3 Data analysis per region: Eastern part of South Africa (SA):

Table 7 below shows detailed actual production costs while Table 8 shows the comparison of various metrics and efficiency ratios across different categories of maize producers (Conventional Tillage (CT), CT to NT/CA transition, and no-till/conservation agriculture (NT/CA).

Table 7 Summary of combined actual production cost for each production practice of the eastern parts of SA (5-year period)

Summary calculations: Eastern parts of South Africa: Average of all producers per year as per production practise										
	Conventional Farmer (CT)					No-till/Conservation Farmers (NT/CA)				
	Average of all CT Farmers					Average of all NT/CA Farmers				
	CT 2019	CT 2020	CT 2021	CT 2022	CT 2023	NT/CA 2019	NT/CA 2020	NT/CA 2021	NT/CA 2022	NT/CA 2023
Year	**2019**	**2020**	**2021**	**2022**	**2023**	**2019**	**2020**	**2021**	**2022**	**2023**
Yield (t/ha)	5,47	5,67	6,99	5,48	6,32	6,65	3,41	5,12	4,96	5,23
Average Producer Price (R/ton)	2,382	2,686	3,030	4,064	3,179	2,382	2,686	3,030	4,064	3,179
Gross Farm income (GFI)	**13,034**	**15,231**	**21,167**	**22,261**	**20,099**	**15,837**	**9,158**	**15,516**	**20,156**	**16,627**
Direct variable cost										
Seed	R 2,149	R 1,951	R 1,836	R 1,841	R 2,448	R 2,558	R 2,858	R 2,687	R 2,767	R 2,784
Fertiliser	R 2,458	R 2,711	R 3,836	R 3,326	R 5,758	R 2,365	R 2,524	R 2,652	R 2,959	R 5,799
Lime	R 44	R 70	R 233	R 223	R 123	R -	R -	R 90	R -	R -
Chemical cost	R 936	R 936	R 1,071	R 1,075	R 1,219	R 715	R 1,939	R 1,168	R 1,172	R 1,980
Insurance (hail)	R 62	R 255	R 260	R 73	R 446	R 769	R 326	R -	R -	R 528
Marketing cost	R 153	R 78	R 198	R 232	R 394	R 367	R 148	R 290	R 431	R 415
Contract work	R 208	R 233	R 182	R 249	R 314	R 568	R 408	R 462	R 75	R 346
Labour	R 22	R 6	R 5	R -	R 42	R -	R -	R -	R -	R -
Diverse expenses	R 3	R 3	R -	R -	R 62	R 1	R -	R -	R -	R -
Fuel	R 1,045	R 1,031	R 928	R 1,353	R 1,958	R 702	R 589	R 801	R 1,240	R 1,508
Repair and maintenance	R 1,159	R 1,303	R 1,272	R 1,765	R 1,882	R 858	R 1,149	R 1,095	R 2,167	R 1,664
Transport cost	R 49	R 21	R 16	R 12	R 5	R -	R -	R 10	R 9	R 275
Dry, Clean & Storage	R 83	R 101	R 93	R 77	R 191	R 70	R 121	R 94	R 112	R 161
Total variable cost	**R 8,370**	**R 8,697**	**R 9,930**	**R 10,225**	**R 14,842**	**R 8,973**	**R 10,061**	**R 9,349**	**R 10,932**	**R 15,458**
Total variable cost	**R8,362**	**R8,697**	**R9,930**	**R10,225**	**R14,842**	**R8,973**	**R10,061**	**R9,349**	**R10,932**	**R15,458**
Total overhead cost	**R1,898**	**R1,945**	**R1,475**	**R1,918**	**R2,501**	**R1,846**	**R1,835**	**R1,974**	**R2,269**	**R3,773**
Total cost	**R10,261**	**R10,642**	**R11,405**	**R12,143**	**R17,343**	**R10,819**	**R11,896**	**R11,323**	**R13,201**	**R19,231**
Farming profit/loss	**R2,773**	**R4,589**	**R9,762**	**R10,118**	**R2,756**	**R5,018**	**(R2,738)**	**R4,193**	**R6,955**	**(R2,604)**

Table 8 Summary of margin, break-even calculations and efficiency ratios for each production practice of the eastern parts of SA (5-year period)

Eastern parts of South Africa: Average of all producers per year as per production practise										
	Conventional Farmer (CT)					No-till/Conservation Farmers (NT/CA)				
SUMMARY	Average of all CT Farmers					Average of all NT/CA Farmers				
	CT 2019	CT 2020	CT 2021	CT 2022	CT 2023	NT/CA 2019	NT/CA 2020	NT/CA 2021	NT/CA 2022	NT/CA 2023
	2019	**2020**	**2021**	**2022**	**2023**	**2019**	**2020**	**2021**	**2022**	**2023**
1) NETT MARGIN										
Nett margin (R/ha)	2,773	4,589	9,762	10,118	2,756	5,018	-2,738	4,193	6,955	-2,604
Net margin (R/ton)	507	809	1,398	1,847	436	755	-803	819	1,402	-498
2) BREAK-EVEN & PROFITABILITY										
Break-even yields (t/ha)	4,31	3,96	3,76	2,99	5,46	4,54	4,43	3,74	3,25	6,05
Break-even price (R/ton)	1,875	1,877	1,633	2,217	2,743	1,627	3,489	2,212	2,662	3,677
Profitability (%)	27%	43%	86%	83%	16%	46%	-23%	37%	53%	-14%
3) EFFICIENCY RATIOS										
Cost ratio (total cost/ gross income)	79%	70%	54%	55%	86%	68%	130%	73%	65%	116%
Net margin as % of Gross income	21%	30%	46%	45%	14%	32%	-30%	27%	35%	-16%
Return on production capital	27%	43%	86%	83%	16%	46%	-23%	37%	53%	-14%

Key observations for the Eastern part of SA

1. Yield

Figure 6.25 presents the average maize yield (t/ha) for all producers by farming practice per year, from 2019 to 2023, across the two categories. Yields, in general, were stable for CT over this 5-year term with not much fluctuation. Yields in NT/CA however displayed more variability, starting at 6.7t/ha in 2019, dropping sharply to 3.4 t/ha in 2020, and then recovering to around 5.0–5.2t/ha in subsequent years. However, overall yields for NT/CA were generally lower than CT from 2020 onwards.

Figure 6.26 displays the ratio of maize yields between NT/CA and CT for the eastern parts of SA over two time periods: 2019–2020 and 2022–2023. During 2019–2020, NT/CA yields were 11% higher than the CT yields while during 2022–2023, this yield advantage increased to 24%, showing a significant improvement in NT/CA relative to CT over time. In 2019–2020, NT/CA yields were 10% lower than CT yields. This trend continued in 2022–2023, when NT/CA yields were 14% lower than CT – indicating a yield gap increase between the yields of the 2 different practices.

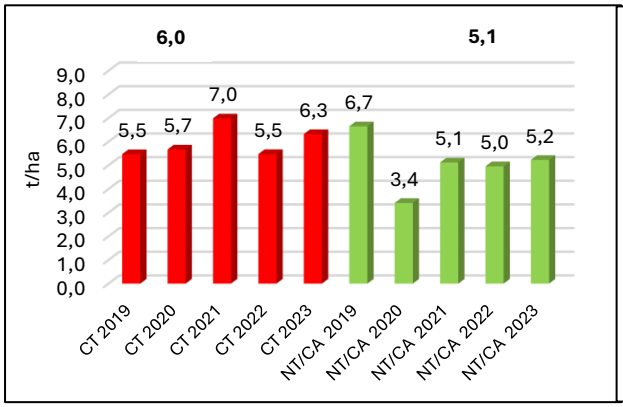


Figure 6.25 Yield: Average of all producers per practice per year (t/ha)

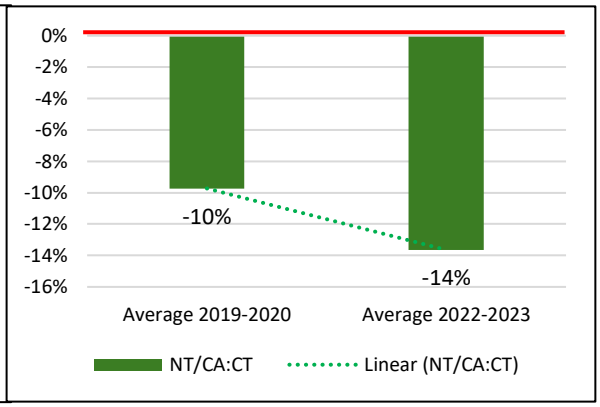


Figure 6.26 Ratio of yield per ton NT/CA to CT

2. Variable Costs

The same as for the NWFS and NW, the total variable costs per hectare for all two farming systems in the Eastern parts of SA show a consistent increase in total variable costs from 2019 to 2023 (**Figure 6.27**). To address variability in the total production cost data, averages were again calculated for the 2019–2020 and 2022–2023 periods to reduce the impact of fluctuations. These averages, illustrated in **Figure 6.28**, compare the total variable costs (R/ha) for NT/CA against those for CT. During 2019–2020, the variable costs for NT/CA were 12% higher than CT, but this difference decreased to 5% in

2022–2023. This pattern differs from the trends observed in the NWFS, where total production costs for NT/CA were lower than CT.

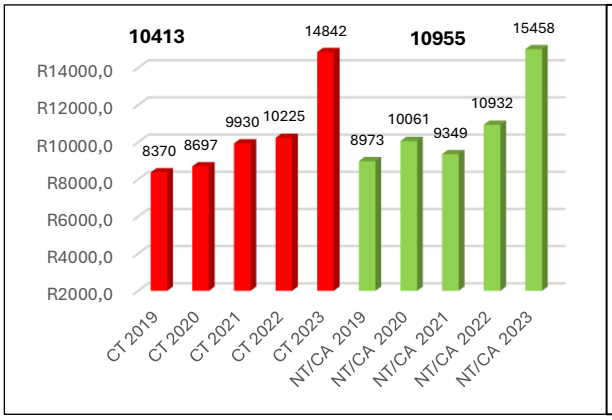


Figure 6.27 Total variable production cost: Average of all producers per practice per year (R/ha)

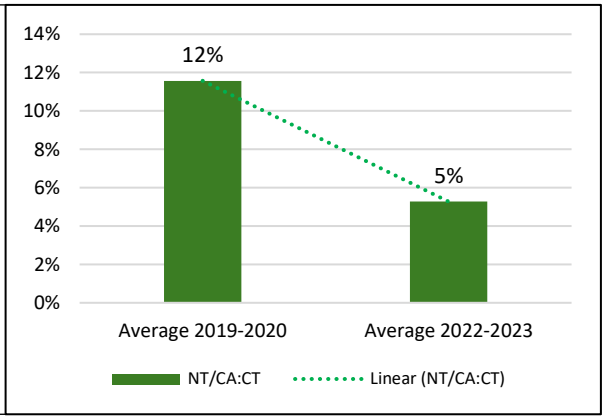
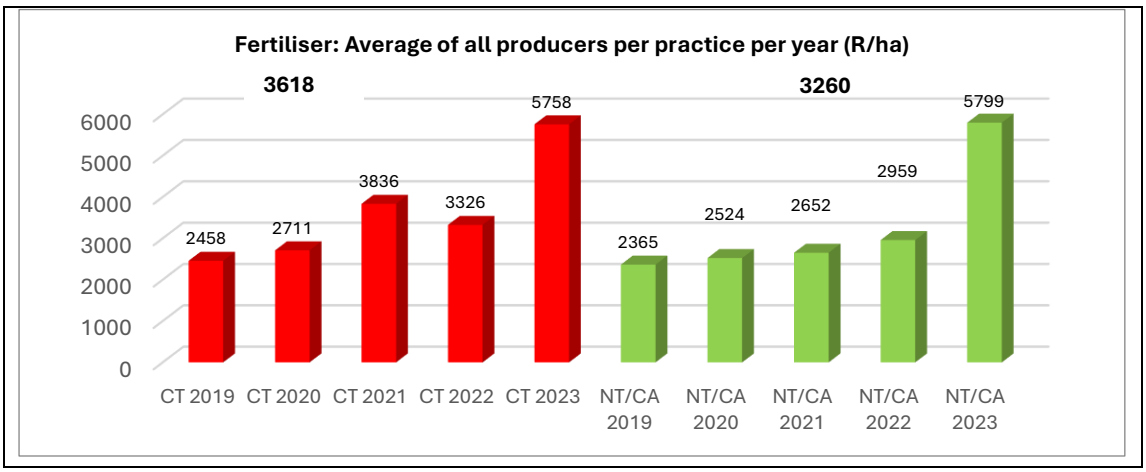


Figure 6.28 Ratio of total variable production cost per ha NT/CA to CT

% Share of each input to total variable cost

Similar trends are observed in the eastern parts of SA compared to the other two regions already discussed, the percentage share of fertiliser costs has seen annual increases across all farming practices. Fertiliser continues to be a major factor in the overall variable costs for both CT and NT/CA. The same as for the other regions, pest and weed control costs are also higher in CA practices compared to CT which is due to reduced tillage in CA systems, which can require more intensive chemical control to manage weeds. CT practices also show higher fuel and repair and maintenance costs compared to NT/CA which again reflects the heavier reliance on mechanisation in CT, leading to greater fuel consumption and more frequent equipment repairs and maintenance.



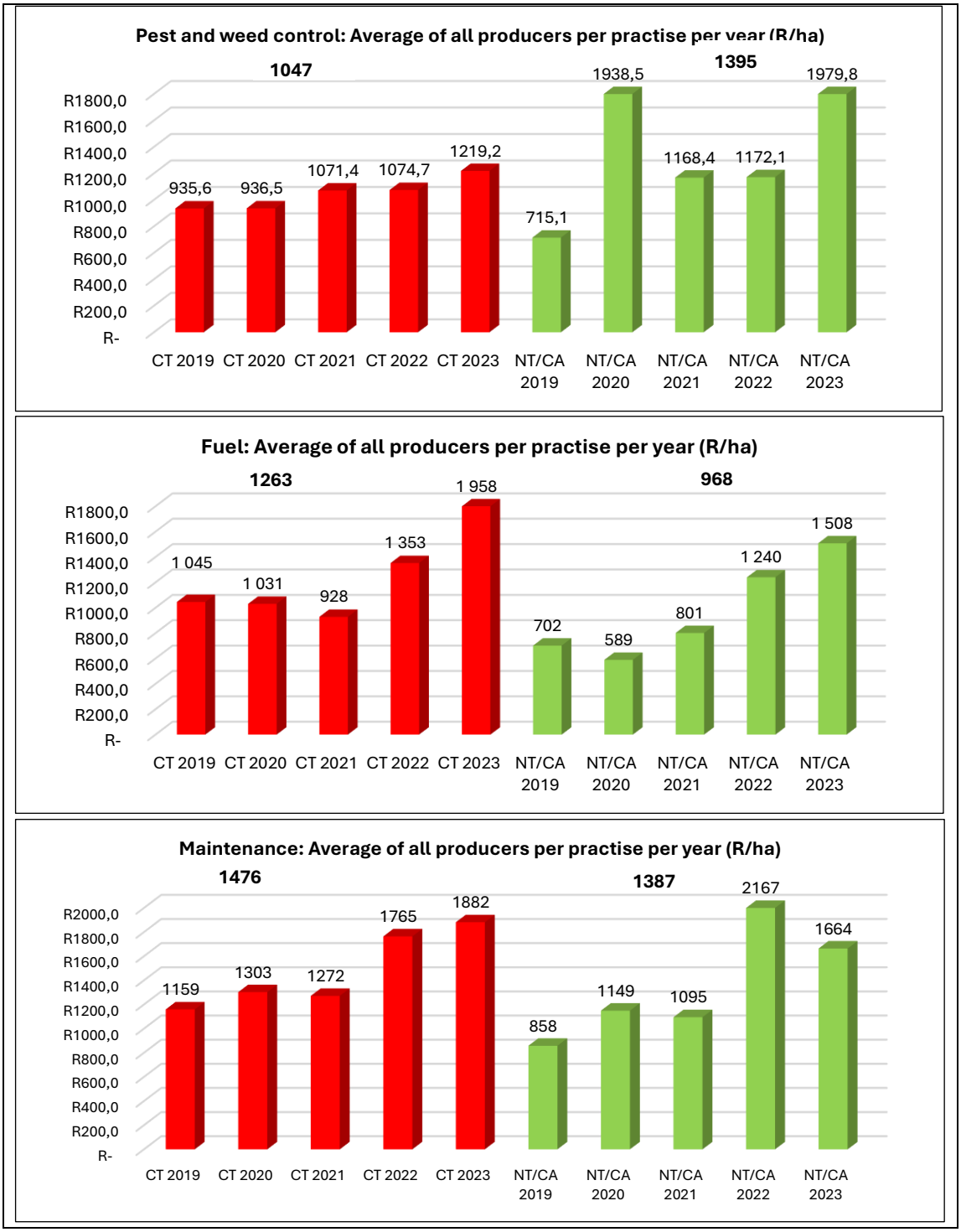


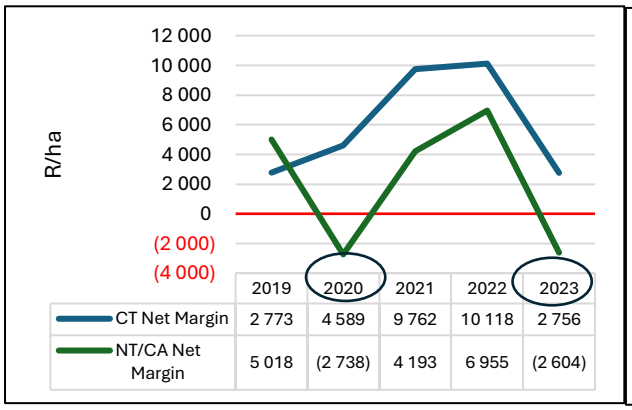
Figure 6.29 % Share of fertiliser, fuel, pest and weed control and maintenance to total variable cost for the NW

CT = Conventional Tillage; NT/CA = no-till/conservation agriculture

3. Net Margin

Figure 6.30 shows the net margins for maize production in the eastern parts of SA across the two different farming practices for the years 2019–2023. CT show greater stability in their net margins, demonstrating a stronger financial position over the years, despite the decline in 2023. On the contrary, NT/CA face more volatility and challenges, with inconsistent net margins highlighting potential challenges associated with the transition to NT/CA.

To address variability in the margin data, averages for the 2019–2020 and 2022–2023 periods were again calculated to smooth out fluctuations (**Figure 6.31**). During 2019–2020, NT/CA margins were 69% lower than CT while it was 66% lower than CT during the 2022–2023 period. Analysis of the data reveals that the lower yields obtained for NT/CA significantly contribute to the lower or negative net margin situation for this practice.



	2019	2020	2021	2022	2023
CT Net Margin	2 773	4 589	9 762	10 118	2 756
NT/CA Net Margin	5 018	(2 738)	4 193	6 955	(2 604)

Figure 6.30 Net Margin for the different production practices per year (R/ha)

CT = Conventional Tillage; CT-NT/CA = Transition Phase; CA = no-till/conservation agriculture

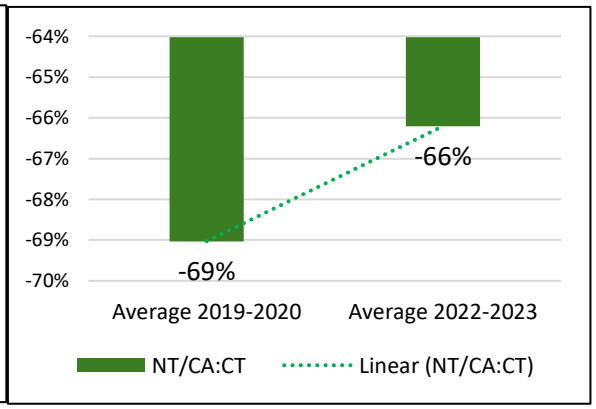


Figure 6.31 Ratio of net margin per ha NT/CA to CT (%)

4. Break-even calculations & Profitability

- Break-even Yield (t/ha): The break-even yield required for NT/CA is higher in most years compared to CT. This indicates that NT/CA practices necessitate higher yields to achieve profitability, highlighting the greater potential production challenges faced by producers adopting NT/CA in this region. The increased break-even yields may be attributed to higher input costs and potential inefficiencies during the transition to conservation practices.

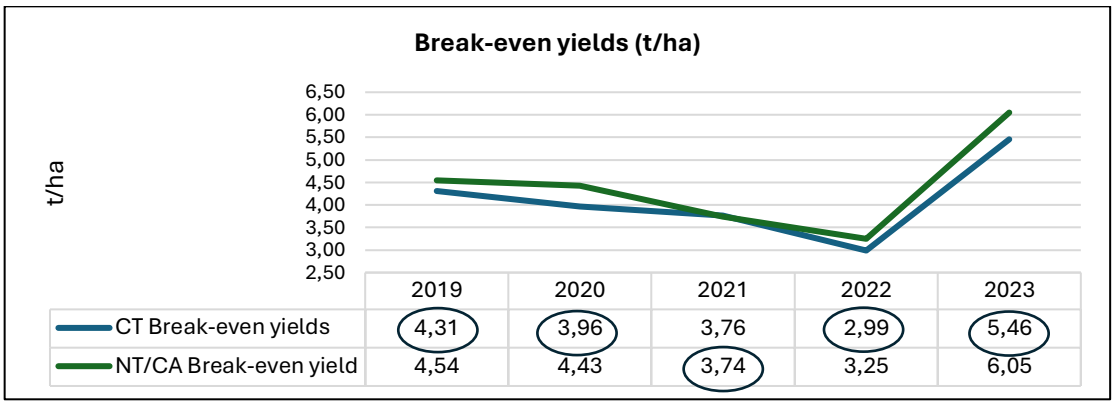


Figure 6.32 Break-even yields for the different production practices per year for the eastern parts of SA (t/ha)

*The lower the break-even the better

- Break-Even Price (R/t): The break-even price for CT remained relatively stable between R1 875/ton and R2 217/ton from 2019 to 2022, before increasing to R2 743/ton in 2023. This suggests increasing input costs or lower income during that year, driving up the price required to break even. Break-even prices for NT/CA were more volatile. After starting at R1 627/ton in 2019, the price jumped to R3 489/ton in 2020 before settling back to around R2 212–R2 662/ton in 2021 and 2022. By 2023, the break-even price surged to R3 677/ton, reflecting increasing costs and greater financial pressure.

  The break-even price required is generally lower for CT producers (and more stable) compared to NT/CA producers, indicating that CT producers are in a better financial position. This suggests that CT producers can achieve profitability with lower prices, whereas NT/CA producers face greater financial pressure, needing higher prices to break even due to higher production costs.

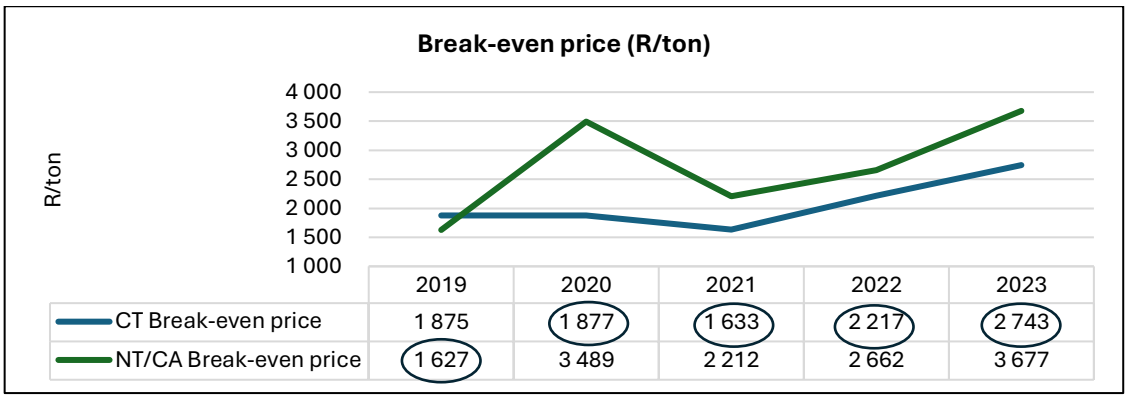
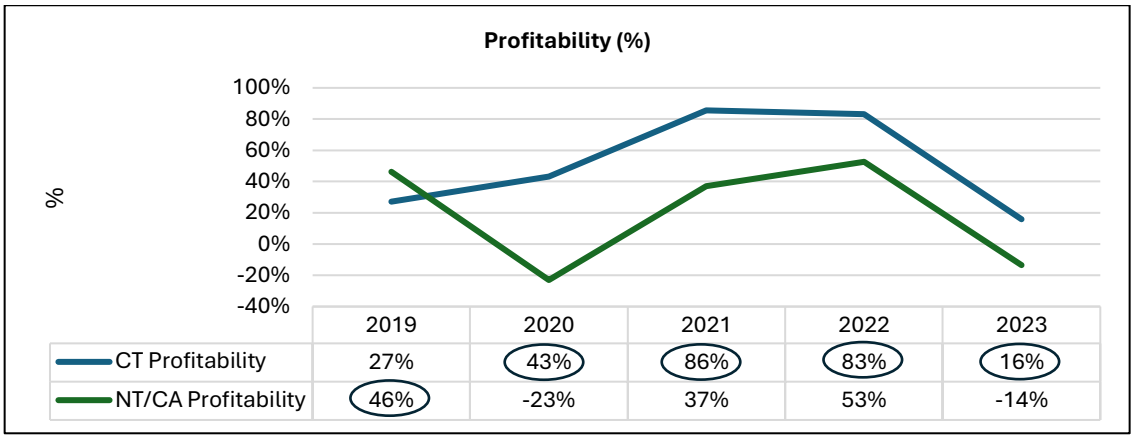


Figure 6.33 Break-even price for the different production practices per year for the eastern parts of SA (R/ton)

*The lower the break-even the better

- Profitability (%): Profitability for CT producers was generally good from 2020 to 2022 peaking at 86% in 2021. However, it dropped significantly to 16% in 2023, indicating that

the particularly high total variable production cost (**Figure 6.34**) is eroding profitability. Profitability in NT/CA was more erratic, with a high of 46% in 2019 but a substantial loss of 23% in 2020. After recovering to 53% in 2022, profitability turned again negative in 2023 (-14%), indicating a challenging cost structure and financial performance.



	2019	2020	2021	2022	2023
CT Profitability	27%	43%	86%	83%	16%
NT/CA Profitability	46%	-23%	37%	53%	-14%

Figure 6.34 Profitability for the different production practices per year for the eastern parts of SA (%)

*The higher the % the better

5. Efficiency ratios

From **Figure 6.35** it is noted that CT practices display a more stable cost control and profitability trends, although the increase in the cost ratio in 2023 reflects increasing pressure on margins. After analysing the actual production cost data for the eastern parts of SA, it is noted that NT/CA are faced with greater fluctuations, with two years (2020 and 2023) where costs exceeded income, highlighting potential challenges in maintaining profitability in this system for this area. However, there are periods of strong performance, particularly in 2022.

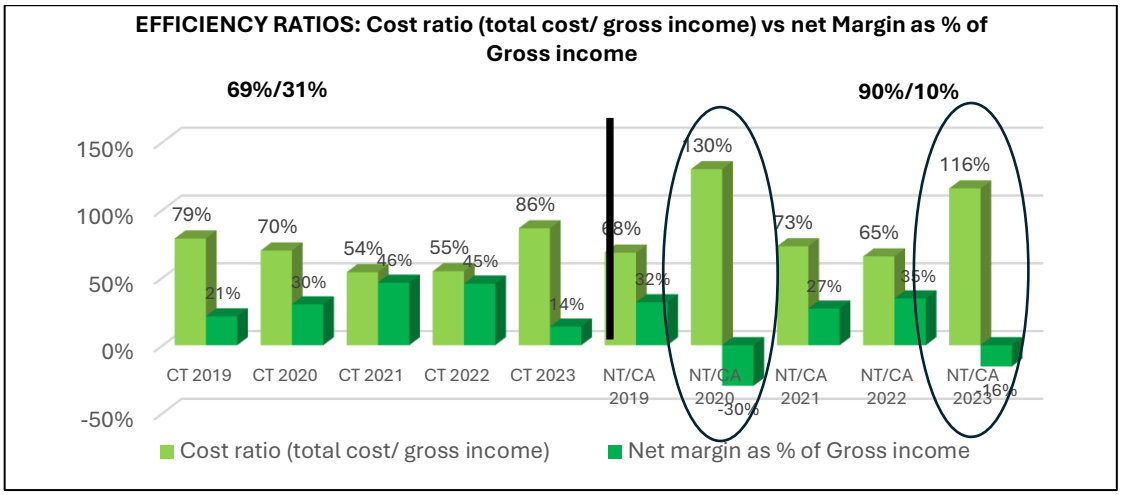


Figure 6.35 Efficiency ratios for the Eastern parts of South Africa

7. Conclusion

This report addressed the research question regarding: What were the actual production costs per hectare for different systems in South Africa's main maize-producing areas?

By using detailed production cost data from multiple regions, the study provided a comprehensive financial comparison of the historic and actual production cost of maize between the systems. We successfully conducted a retrospective financial comparison, providing valuable insights into the profitability of each system (with a focus on only maize). In line with the **aims** of the study:

1. **Evaluating Sustainability and Profitability:** Over a 5-year period, the study evaluated the sustainability and profitability of each system. Overall, the results indicate that NT/CA systems are most successful in regions like NWFS, where the long-term benefits of NT/CA have become more pronounced. In regions like NW and the Eastern parts of South Africa, NT/CA practices still face challenges, particularly in terms of cost management and yield stability, but show potential for greater profitability with continued adaptation.

2. **Identifying trends in production cost and input efficiency:** The report highlighted distinct trends in total production costs, while also providing detailed insights into the percentage share of key inputs such as fertiliser, fuel, repair and maintenance, and pest and weed control. Additionally, the analysis covered trends in break-even calculations, profitability, and efficiency ratios. Across all regions, input costs, particularly for fertiliser and pest control, increased significantly over the 5-year period. NT/CA systems generally reduced fuel and maintenance costs due to less tillage, but the impact of higher chemical inputs for weed and pest control needs to be managed, especially in regions like NW and the Eastern parts of South Africa. NT/CA systems displayed improved input efficiency in regions like NWFS, where total production costs decreased over time. However, in the NW and Eastern regions, NT/CA systems still face challenges with high total input costs suggesting the need for ongoing refinement in these areas. While NT/CA systems improved yields in NWFS and NW regions, surpassing CT by 2022-2023, the Eastern region showed more yield volatility. Yield trends highlight that NT/CA can achieve higher results with time and adaptation, but the transition period can vary significantly depending on regional conditions.

3. **Improving transparency:** By obtaining actual and historic production cost data from multiple sources, the report improved transparency in cost practices, promoting greater accountability and more informed discussions about farming practices. This transparency is crucial for benchmarking and for producers to understand the economic performance of their operations compared to others.

As for the **objectives**:

1. **Producer Selection:** The study successfully selected farms representing Conventional Tillage (CT), Transition Phase (TP), and No-till/Conservation Agriculture (NT/CA) systems across key maize-producing regions of South Africa. Though some challenges were faced in collecting direct data from producers, the alternative methods provided robust insights.

2. **Data Collection:** Actual production cost data was collected for a 5-year period, allowing for a detailed and accurate analysis of farming practices. This data enabled the thorough comparison of the three systems and offered insights into the financial viability of each.

In conclusion, all aims and objectives were addressed successfully in this report. The analysis provides a clear and practical understanding of the financial viability of different maize farming practices, helping stakeholders make more informed decisions regarding sustainability and profitability. The data supports the view that NT/CA practices, while initially more expensive, offer superior long-term benefits in terms of yields, profitability, and cost efficiency, especially in regions like the NWFS. However, the findings also emphasise that regional variability means further adaptation is necessary for conservation practices to achieve their full potential in areas like the North West and eastern parts of South Africa.