

# Cassava root yield response to tillage intensity, planting density and fertilizer across south western Nigeria

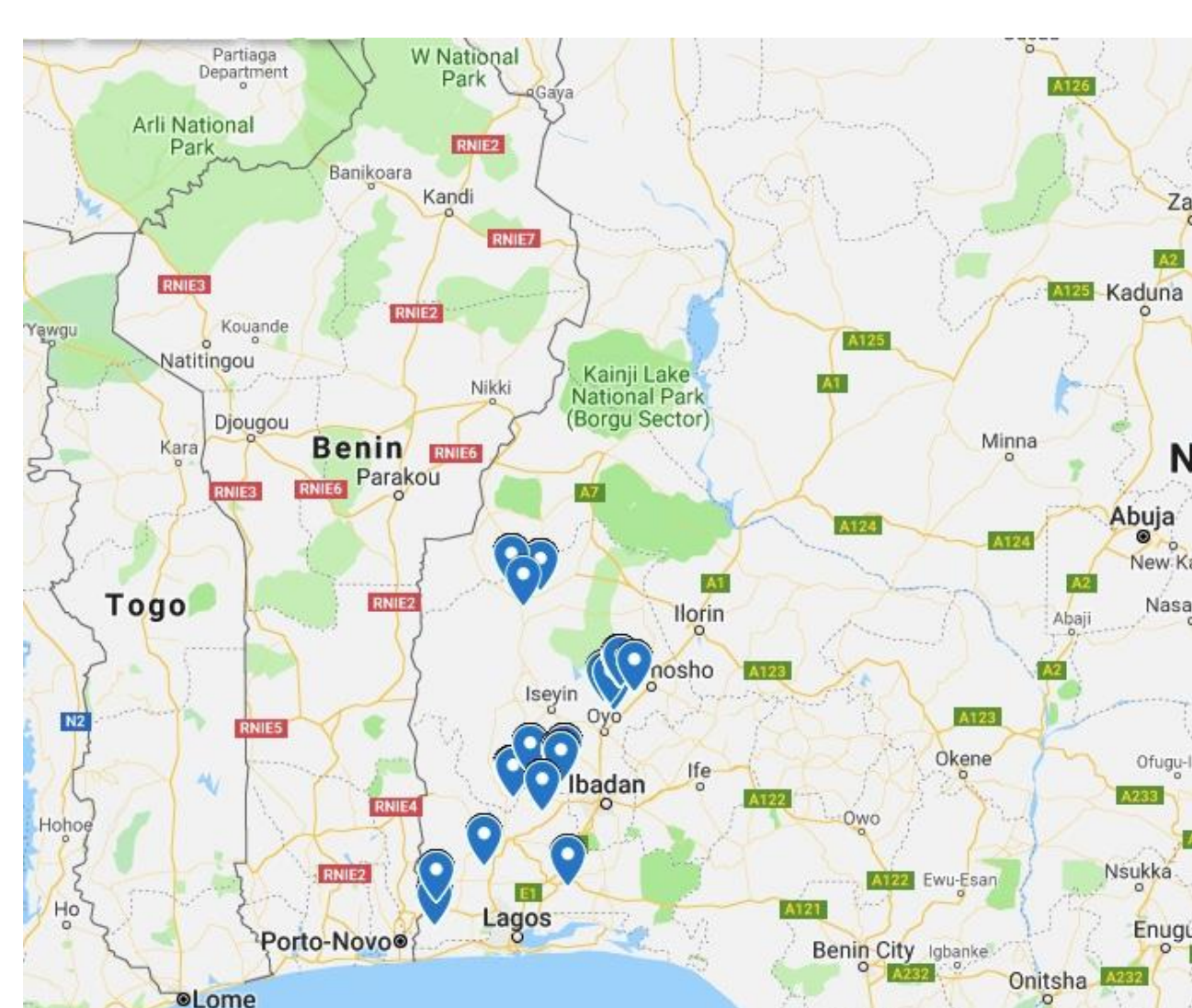
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## Introduction

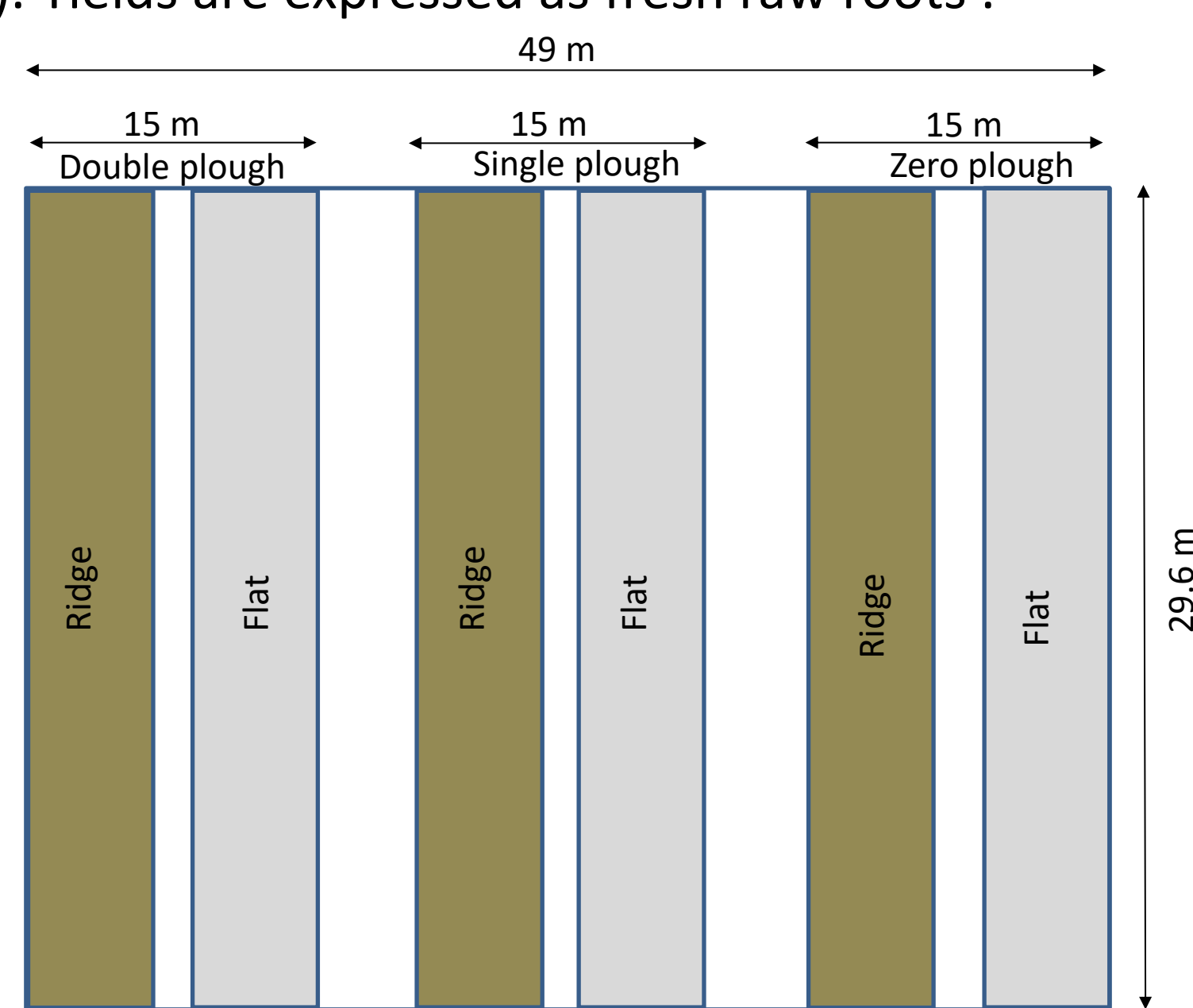
Cassava is growing in importance in Nigeria as food security and industrial crop. Current yields are low, while production costs are high. Tillage, weed control and fertilizer are the main cost factors. Low planting density may be a cause of low yields. To provide agronomic recommendations targeted at reducing production costs, while increasing yields, the effects of tillage intensity, fertilizer application and increased plant density were tested in about 50 farmers' fields in south western Nigeria over two years.

## Materials and Methods

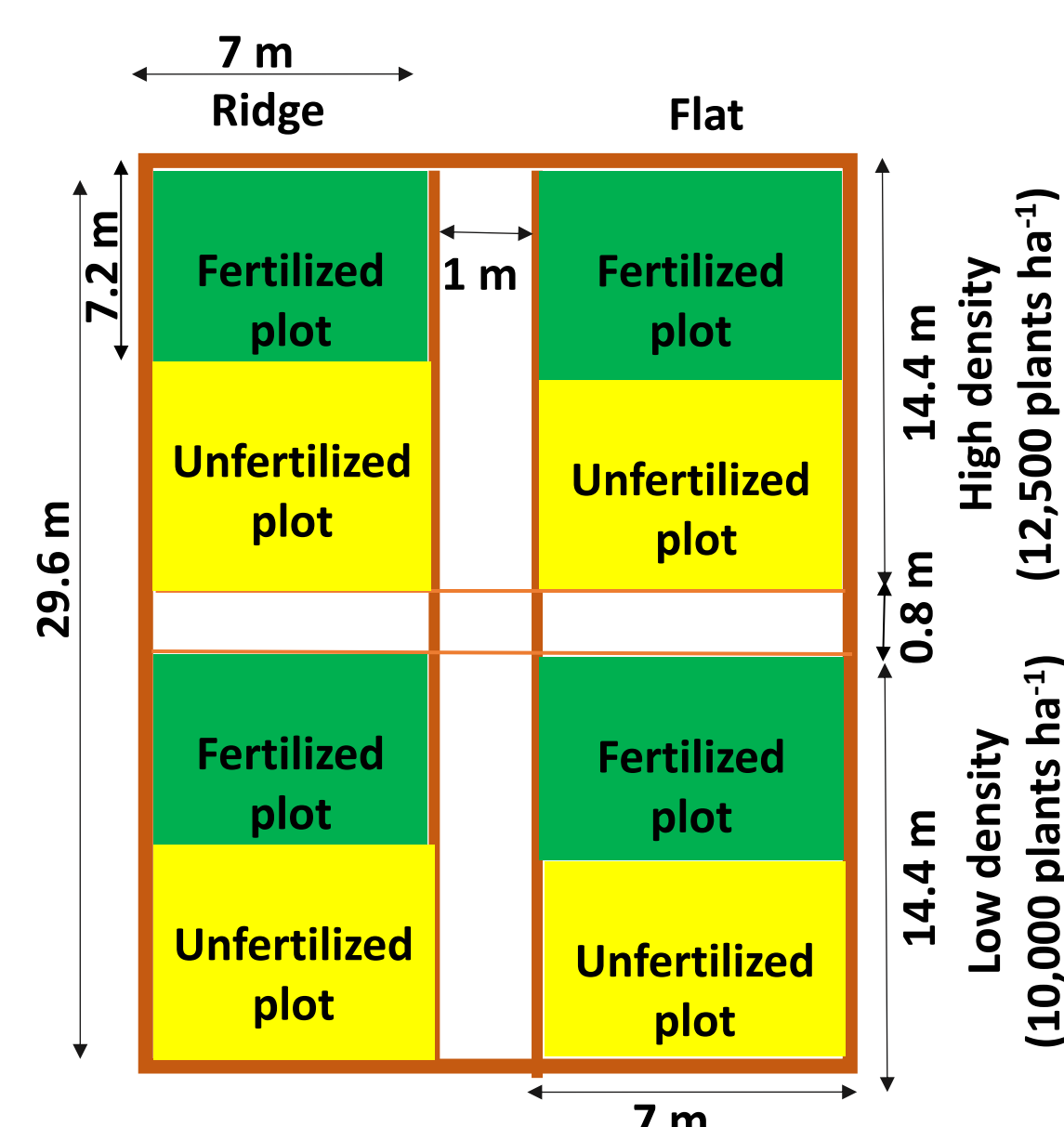
Trials were established in Oyo and Ogun states of western Nigeria creating a north south gradient (Fig. 1). In 2016 tillage treatments imposed in each field were zero, single and double disc ploughing, followed by ridging (soil shaping) versus leaving the soil flat (Fig. 2). Fertilizer application was NIL versus 75:20:90 kg ha<sup>-1</sup> NPK, plant density (PD) was 10000 versus 12500 ha<sup>-1</sup> (Fig. 3). In 2017 plant density was kept at 12500 ha<sup>-1</sup> and double ploughing was eliminated. Due to the risk of poor weed control introducing bias, a pre and post emergence herbicide application was compared with the farmers' choice of weeding. Crops were harvested at 12 months after planting (MAP). Yields are expressed as fresh raw roots.



**Figure 1: Trial locations in both years.**



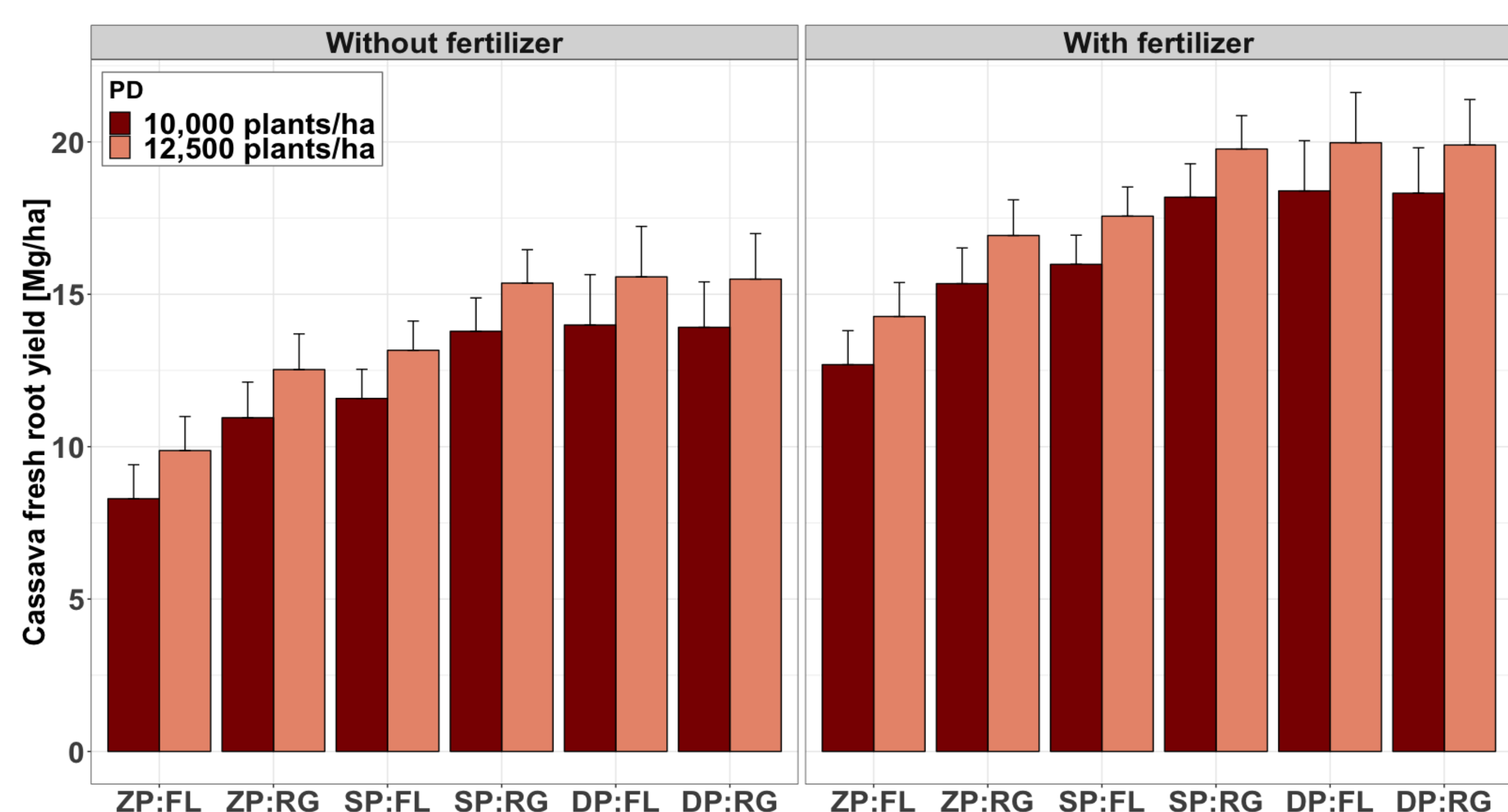
**Figure 2: Layout of the ploughing and ridging treatments.**



**Figure 3: Plot layout of soil shaping, plant density and fertilizer application within the different ploughing treatments (double, single or zero plough passage).**

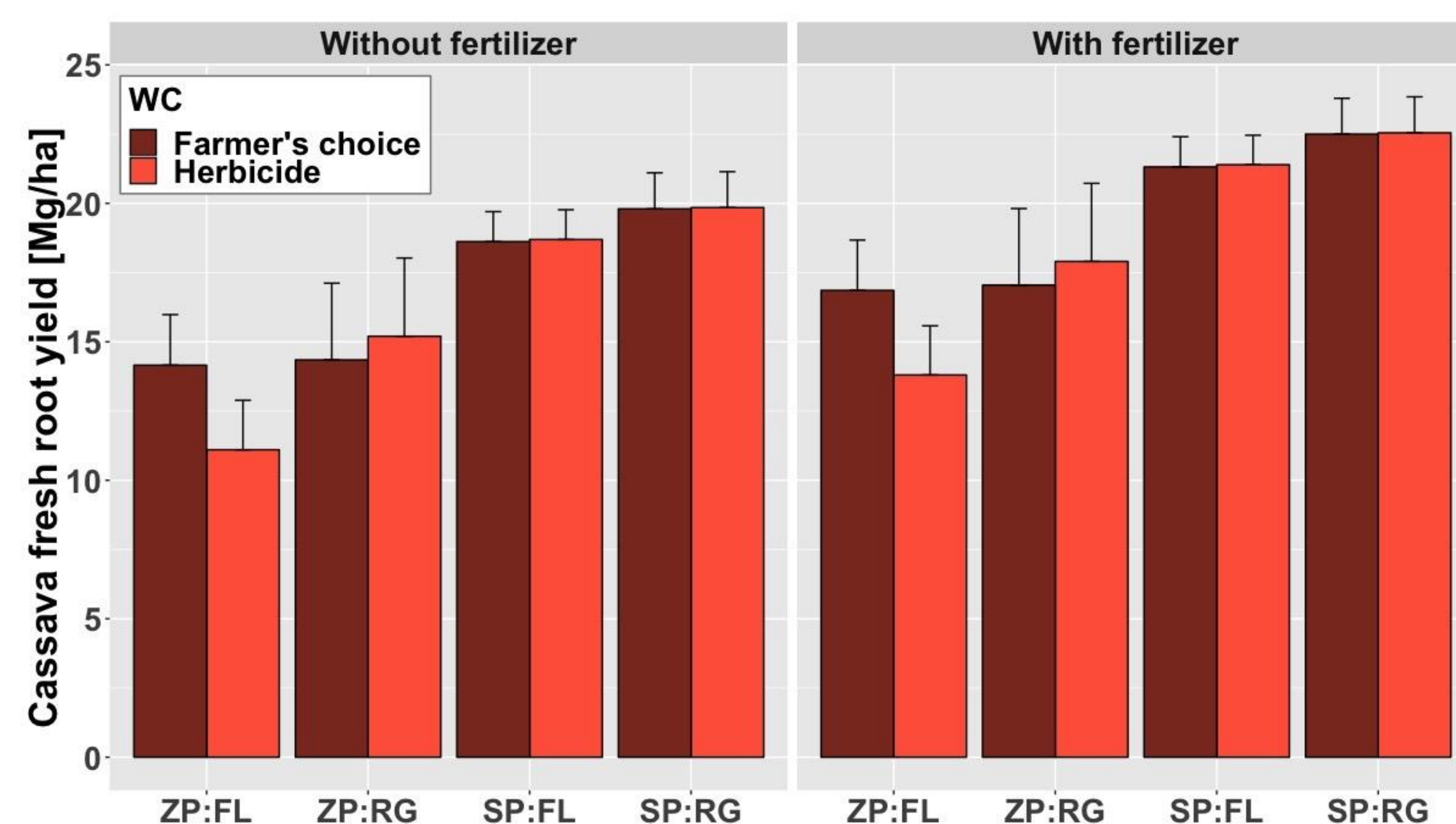
## Results and Discussion

In 2016, double ploughing (16.94 Mg ha<sup>-1</sup>) had no advantage over single ploughing (15.67 Mg ha<sup>-1</sup>), zero plough produced 12.61 Mg ha<sup>-1</sup> (Fig. 4, p<0.004). Ridging increased yield significantly by 2.21 Mg ha<sup>-1</sup> and 2.66 Mg ha<sup>-1</sup> after single and zero ploughing, respectively, yet caused no change in double plough (Fig. 4). Increasing plant density had a significant effect (+ 1.58 Mg ha<sup>-1</sup>) and fertilizer application increased yields by 4.40 Mg ha<sup>-1</sup> across tillage treatments.



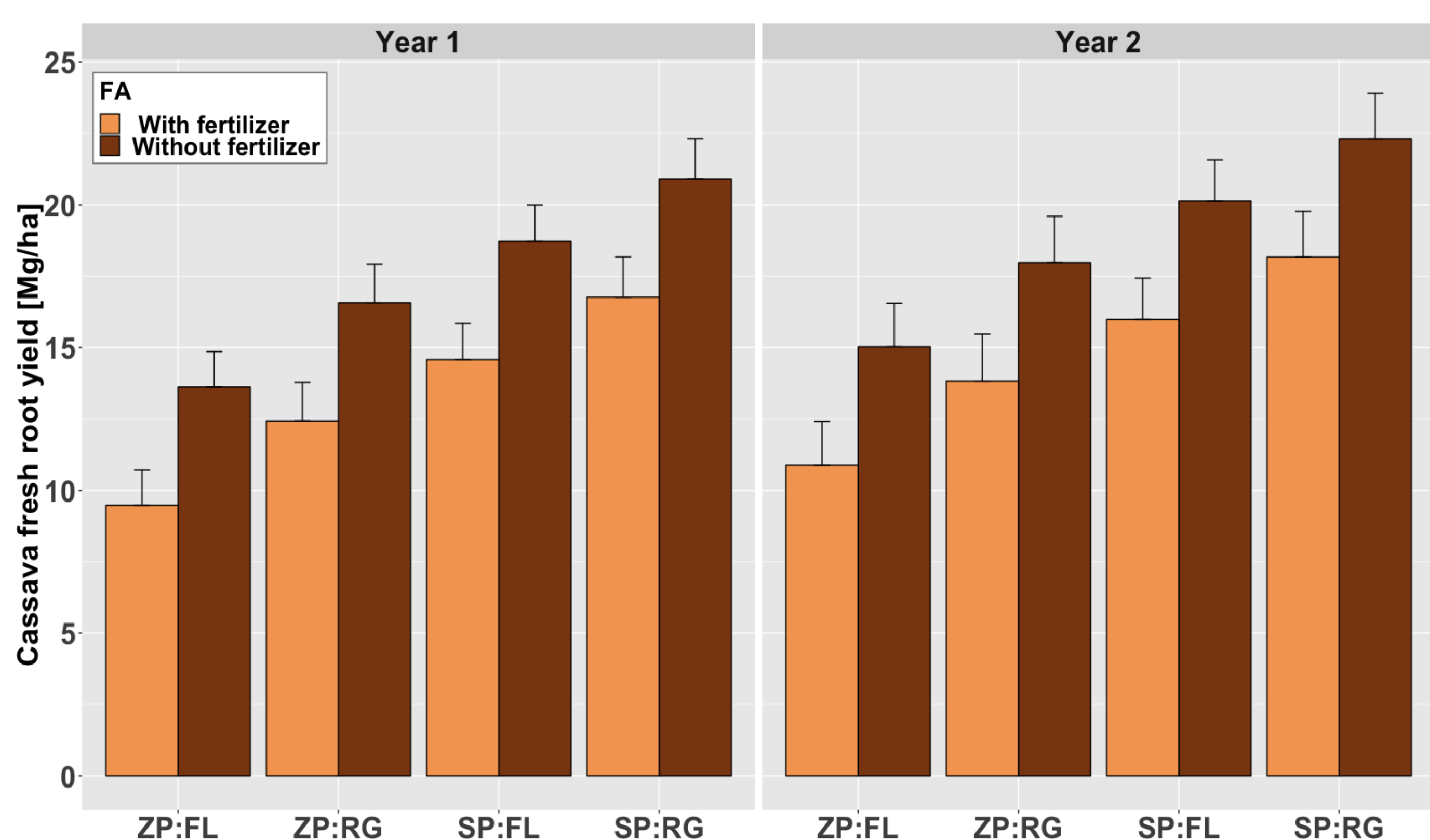
**Figure 4: Effect of ploughing, ridging, plant density and fertilizer application on cassava fresh root yield in farmers' fields in 2016.** PD: Plant Density; ZP: Zero Plough; SP: Single Plough; DP: Double Plough; FL: Flat; RG: Ridge

In 2017, single ploughing increased yields by 5.54 Mg ha<sup>-1</sup>, ridging by 1.66 Mg ha<sup>-1</sup> and fertilizer application increased root yields by 2.0 Mg ha<sup>-1</sup> (Fig 5). The use of herbicides instead of farmers choice of weed control (manual weeding) had no significant effect on cassava yields, yet reduced costs.

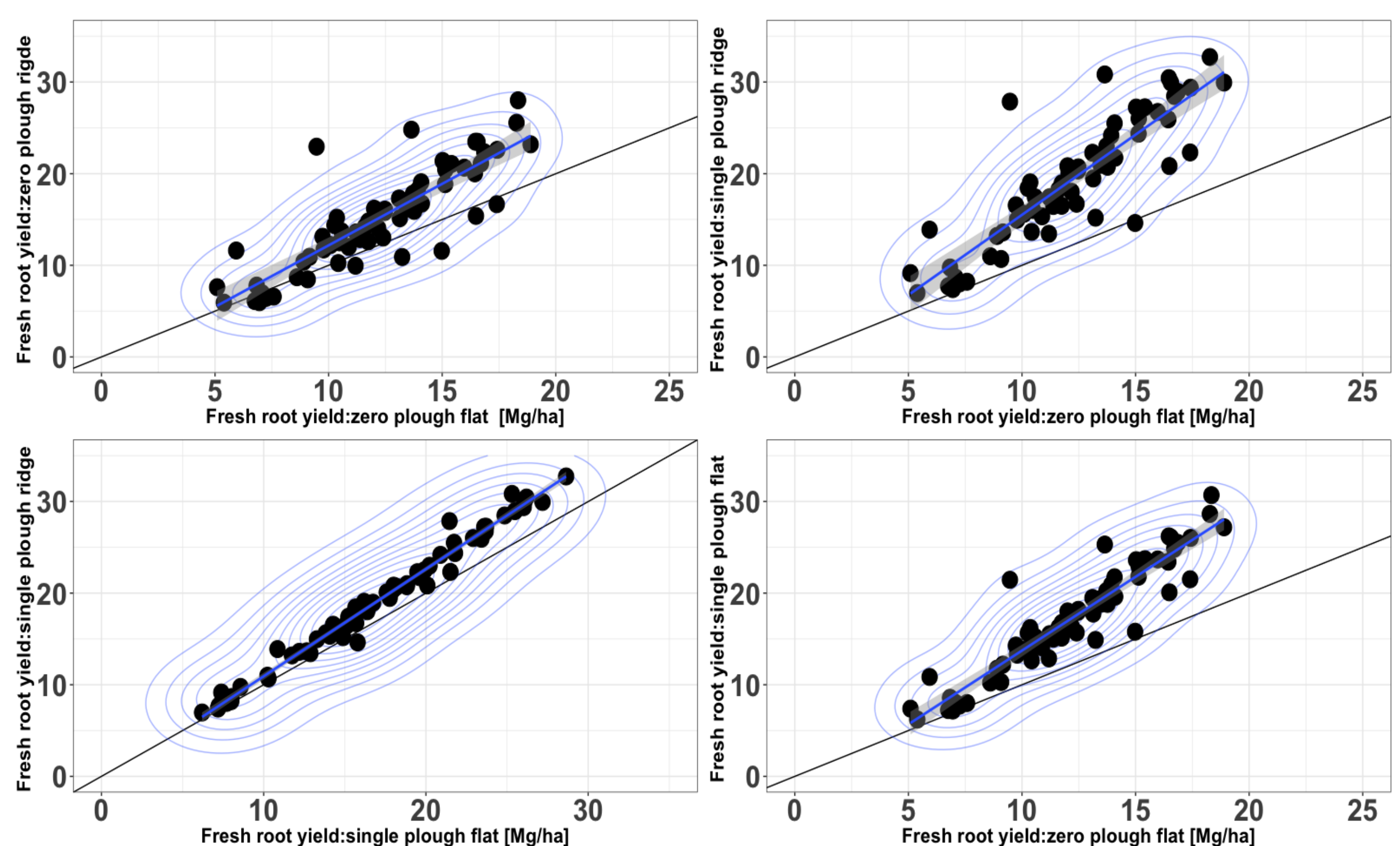


**Figure 5: Effect of weed control (WC), fertilizer application and tillage intensity on cassava fresh root yields in farmers' fields in 2017.** ZP: Zero Plough; SP: Single Plough; FL: Flat; RG: Ridge

Fertilizer application consistently significantly increased fresh root yield in both years and all tillage treatments (Fig. 6). Root yield had a significant ploughing × ridging interaction with increases when ridged being 2.95 Mg ha<sup>-1</sup> in zero plough plots and 2.2 Mg ha<sup>-1</sup> after single ploughing (Fig 7).



**Figure 6: Effect of fertilizer application and tillage intensity on cassava fresh root yields. Means of 2016 and 2017.** ZP: Zero Plough; SP: Single Plough; FL: Flat; RG: Ridge



**Figure 7: Cassava fresh root yield response to ploughing and ridging.**

## Conclusion

The root yield response to tillage was strongly dependent on the yield attained without tillage. At yields <10 Mg ha<sup>-1</sup> tillage did not affect yields; as of >10 Mg ha<sup>-1</sup> yield increases by ploughing and ridging were attained. This information is combined into a decision support tool to allow farmers estimate the benefits possible with increased tillage intensity through increased yields or reduced tillage through cutting costs.

## Acknowledgements

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