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Extended-abstract paper

Effect of harvest time on N-fertiliser requirements in the Wet Tropics

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The time of year when sugarcane is harvested and ratooned significantly affects cane yields. Previous research has shown that sugarcane crops harvested and ratooned late in the season often yield significantly less than crops harvested earlier in the season (Di Bella *et al.* 2008; Lawes *et al.* 2001). The effect of harvest time on cane yields is complex but is largely due to the climatic conditions into which the ratooning crop grows. Crops ratooned late in the year grow into conditions of high temperature and can accumulate leaf area quicker than crops ratooned earlier in the year. However, the rate at which these crops then accumulate biomass is affected by the amount of solar radiation intercepted. Summer in the Wet Tropics coincides with the wet season and this increases the risk of experiencing high rainfall, excessive cloud cover, lower solar radiation and prolonged periods of waterlogging. The effects of waterlogging are greatest on young crops, hence waterlogging also poses a real threat to the growth of late-harvested crops (Rudd and Chardon 1977; Mitchell *et al.* 2001). In addition, the application of nitrogen (N) fertiliser to late-harvested crops often coincides with the onset of the wet season and typically higher rainfall. This increases the risk of N losses and may restrict crop-N uptake. Given the lower yield potential of late-harvested crops and climatic conditions often experienced, it is surprising that previous research has not determined the impact of harvest time on N-fertiliser requirements.

Two small-plot N-response experiments were established at Tully to evaluate crop responsiveness to applied N at different harvest times. There were four N treatments (70, 110, 130 and 150 kg N/ha) and two harvest-time treatments (mid = August and late = November). The experiments consisted of a fully randomised split-block design with N treatment as the horizontal factor and harvest time the vertical factor and were located on a well-drained (Tully series) and poorly-drained (Coom series) soil formed on alluvium (Murtha 1986). Based on the total spring and summer rainfall, the growing season of the first-ratoon and second-ratoon crops was considered dry (784 mm) and normal (1869 mm), respectively (Skocaj and Everingham 2014). However, during the second-ratoon crop an extreme rainfall event resulted in widespread flooding of the Tully River in early January 2017.

There was no statistically significant interaction between N rate and harvest time in the first- or second-ratoon crops at both the well- and poorly drained sites for biomass (fresh or dry), yield (cane, sugar, CCS) or N uptake. This indicates N requirements were similar for mid- and late-harvest treatments.

In the second-ratoon crops, harvest time had a statistically significant effect on N uptake and cane yields at both the well- and poorly drained sites. In the mid-harvest treatments, significantly more N was recovered (18.1 and 26.5 kg N/ha at the well- and poorly drained sites, respectively) in the aboveground crop components (stalk, green leaf and cabbage). The timing between fertiliser application and the first major rainfall event appeared to have a strong influence on N recovery. The first major rainfall event occurred 12.6 weeks after applying fertiliser to the mid-harvest treatments, but only 3.6 weeks after fertilising the late-harvest treatments. Crops harvested and ratooned late in the season are more likely to experience major rainfall events soon after N fertiliser is applied. Despite the late-harvest treatment recovering significantly less N, cane yield was not restricted at the well-drained site. However, at the poorly drained site, cane yields were significantly lower for the late-harvest treatment (9.8 t cane/ha less than the mid-harvest treatment) due to prolonged waterlogging and reduced N uptake restricting crop growth. At this site, cane yields also significantly increased up to 130 kg N/ha. This is consistent with the SIX EASY STEPS N guidelines for ratoon crops at the site based on the soil organic-carbon value (Schroeder *et al.* 2010).

Our results suggest that position in the landscape and climatic conditions experienced during the growing season, especially immediately following the application of N fertiliser, have a significant influence on crop growth, N uptake and N losses. It may be possible to reduce N rates on crops harvested and ratooned late in the season without adversely affecting productivity, provided N losses can be minimised.

Additional biomass, yield and N-uptake data are being collected from the third- and fourth-ratoon crops. This will provide more clarity around the consistency (repeatability and reliability) of the responses observed in the first- and second-ratoon crops and certainty around the ability to reduce N rates for late-harvested crops in the Wet Tropics. It will also allow N requirements for late-harvested crops to be evaluated in older ratoons which are typically ratooned later in the season. Field evaluations of seasonal climate forecasting to guide N-fertiliser application rates and rigorous assessment of enhanced-efficiency fertilisers for improving N uptake and reducing N losses requires further investigation in late-harvested crops.

The information generated from our field experiments will support the development of material for inclusion in the SIX EASY STEPS Toolbox (Schroeder *et al.* 2018) and help refine the SIX EASY STEPS N guidelines for crops ratooned late in the season. This will allow growers and advisors to make more informed decisions when developing whole-of-farm nutrient-management plans in the Wet Tropics (Skocaj *et al.* 2018).

Key words Harvest time, late, ratoon, nitrogen, Tully

REFERENCES

Di Bella LP, Stringer JK, Wood AW, Royle AR, Holzberger GP (2008) What impact does time of harvest have on sugarcane crops in the Herbert River District? *Proceedings of the Australian Society of Sugar Cane Technologists* 30: 337–348.

Lawes RA, Lawn RJ, Wegener MK, Basford KE (2001) Spatial variation of sugarcane productivity in the Tully mill district: Is it worth worrying about? *Proceedings of the Australian Society of Sugar Cane Technologists* 23: 145–148.

Mitchell D, Bohl H, Roth C, Cook FJ (2001) The dynamics of a shallow perched watertable on a heavy soil in the Lower Herbert Valley. *Proceedings of the Australian Society of Sugar Cane Technologists* 23: 148–153.

Murtha GG (1986) *Soils of the Tully-Innisfail Area, North Queensland.* CSIRO Division of Soils, Divisional Report No. 82.

Rudd AV, Chardon CW (1977) The effects of drainage on cane yields as measured by water-table heights in the Macknade mill area. *Proceedings of the Australian Society of Sugar Cane Technologists* 44: 111–117.

Schroeder BL, Hurney AP, Wood AW, Moody PW, Allsopp PG (2010) Concepts and value of the nitrogen guidelines contained in the Australian sugar industry's 'SIX EASY STEPS' nutrient management program. *Proceedings of the International Society of Sugar Cane Technologists* 27: 13 pp.

Schroeder BL, Skocaj DM, Salter B, *et al.* (2018) 'Six Easy Steps' nutrient management program: improving with maturity! *Proceedings of the Australian Society of Sugar Cane Technologists* 40: 179–193.

Skocaj DM, Everingham YL (2014) Identifying climate variables having the greatest influence on sugarcane yields in the Tully mill area. *Proceedings of the Australian Society of Sugar Cane Technologists* 36: 53–61.

Skocaj DM, Telford D, Hurney AP, Schroeder BL (2018) Process for developing farm nutrient management plans in the Wet Tropics. *Proceedings of the Australian Society of Sugar Cane Technologists* 40: 194–201.