GRAIN MAIZE RESULTS SUMMARY – YEAR 2 (2020 – 2021)

10 irrigated grain maize trials were established at two locations in northern Victoria. The primary focus of this second year of field research was to look at the influence of higher levels of nitrogen (N) input on harvest dry matter, grain yield, harvest index, nitrogen offtake and profitability. In addition, the research programme also examined the influence of plant population, row spacing and disease management. At the main research sites in Peechelba East and Kerang, irrigation was provided by overhead pivot and surface irrigation (Flood - border check) respectively. Total irrigation quantities applied were as follows, Peechelba East (Pivot 5.1 Mega L/ha applied) and Kerang (Surface irrigation border check 11.6 MegaL/ha). All research was conducted using the Pioneer Hybrid P1756, the same hybrid used in year one of the programme. To ensure soil type consistency between seasons the principal trials were conducted at the same field research sites (different parts of the paddock) as 2019/20. At Peechelba East on a commercial farm (red loam over clay) the research was conducted under the same pivot as 2019/20 (not on the same area under the pivot) with all trials established into grain maize residues from the previous season, compared to grain maize following oaten hay stubble in the first year of research. At Kerang (self-mulching grey clay) in both years maize research has been conducted following grass dominant pasture.

Grain yields and nutrition

Grain maize crops yielding 16 -19t/ha with dry matters of 33 - 35t/ha commonly remove 400kg N/ha from the soil, but in results generated over the last two years these crops do not respond significantly to N fertiliser inputs greater than approximately 250kg N/ha. Of the nitrogen removed by the crop canopy at harvest approximately 30 – 35% of the N is returned to the soil as stover residues, so based on a 400kg N offtake approximately 120 - 140kg N/ha is returned to the soil as harvest residues. Applications of nitrogen in excess of 250kg N/ha with up to 550kg N/ha experimented upon in the project have been largely uneconomic in the season; these applications lost up to $400/ha depending on the price of N fertiliser and the exact rates of N applied. With applications of N fertiliser commonly applied at levels of 300 – 450kg N/ha on farm for irrigated grain maize it has not been possible to illustrate that such high levels of N input are the route to higher grain yields in this crop. Whilst in an irrigated system it is unclear how much of the excess N is available the following season, research conducted indicates that we need to rethink the profitability of such large doses or at a minimum take account of soil mineralisation for nitrogen applications in irrigated summer crops. At both research sites supply of nitrogen from the soil has been responsible for supplementing fertiliser N in the production of large crop canopies and grain yields in excess of 16t/ha. **Whilst we cannot mine our soils without regard to this contribution, the research has illustrated that in-crop mineralisation in the summer months is an extremely significant contributor to the N budget calculations under irrigation.** Whilst over fertilising can be claimed to be beneficial for following crops it is important to recognise that this research has failed to generate any evidence to suggest that grain maize crops can respond (with statistical significance) to more than 250kg N/ha. Clearly, the level of organic carbon in the soil will vary and contribute different amounts of soil N supply through the course of a season, however the key finding has been our inability to generate significant yield responses up to the levels of fertiliser being applied on farm. At Peechelba East in 2021 the research was conducted in a maize-on-maize scenario in order to test whether economic responses could be secured from higher amounts of N compared to 2020 when maize was grown following oaten hay. Overall grain yields were lower yielding at 16 - 17.5t/ha in 2021 and although 17t/ha crops were

achieved with N rates above 250kg N/ha, the economics were marginal - in some cases slightly positive (Trial 1) and in other cases negative (Trial 3). In no cases at this site over the last two years were statistically significant yield increases achieved with N rates above 250kg. These results have been generated in commercial situation where 200 – 230kg N/ha has been applied as fertigation with applications from V4, V8 and pre VT (tasselling). In 2020 at this site the highest grain yields recorded (machine harvested plots) were 18 - 19t/ha; these were produced on crop canopies fertilised with approximately 250kg N/ha (50N as pre drill urea and the remaining 200N as fertigation).

N timing has failed to generate significant yield effects but for the second year there has been some evidence to suggest split applications, with an emphasis on later applications (up to tasselling), has been associated with higher grain protein. In addition, if large applications were made at sowing as single doses there was evidence to suggest nitrification inhibitors (eNpower) have a role, but yield increases were not statistically significant.

Plant population and row spacing

Over two years plant population and row spacing have been noted to have significant effects on dry matter production and grain yields. Optimum plant populations at Peechelba East maize on maize were lower than those observed following oaten hay in 2020 when yields were higher (18 - 19t/ha). At yields of 16 - 17t/ha when maize followed maize, an economic optimum of 80,000 plants/ha was established compared to 92,000 plants/ha with the same hybrid P1756. Although there was evidence that higher plant populations respond to higher N input, **the best margins ($/ha) from the Peechelba East site in 2021 were generated with 230kg N/ha (applied as fertigation) applied to 80,000 plants/ha.** At Kerang there was no yield advantage associated with higher plant populations (105 - 107,000 plants/m2) of hybrid P1756 compared to 83 - 84,000 plants/m2. Spatial configuration of the low plant populations is an important consideration from results generated so far, with data suggesting that narrower row spacing combined with lower plant populations may offer higher productivity than the traditional 750mm row spacing. **In 2021 at Kerang the combination of 500mm row spacing and lower plant population generated the highest grain yields on the research site.** At Boort in 2020 decreasing row spacing from 750mm (approx. 30 inch) to 500mm (approx. 20inch) significantly increased grain yield with a 3.46 t/ha yield increase (trials hand harvested). This will be a major emphasis of the final year of research in 2021/22 as it has been one of the few factors, other than overall N input, to significantly influence maize grain yield. Poorer establishment in that trial resulted in no significant differences due to plant population.

Foliar nutrition

The project with the assistance and support of industry evaluated a number of different foliar applications of both macro and micronutrients in 2021. At Peechelba East these liquid fertilisers (based on calcium nitrate and Natures K) were applied as supplement applications on top of a standard N fertigation strategy (based on 230N) and a higher N input of 420kg N/ha at V5, V7 and up to V9. There were some interesting interactions and significant effects on total dry matter produced but no statistically significant yield responses over the standard N controls. Potassium levels in the newest tissue were shown to be low at this site when assessed at tasselling, but none of the treatments were seen to significantly increase K concentration in the upper leaves relative to the untreated crops. At Kerang an application of Spraygro Complete K (an NPK trace element liquid) applied at silking and 14 days after silking had no impact on yield. Monitoring of tissues at Kerang revealed tissue levels of key

elements to be sufficient when assessed at silking, apart from N concentration. In this first year of evaluation the significance of the results generated did not live up to the level of discussion that generated the research programme. Work in this area will continue in 2022.

Rotation Position

To better understand the effect of previous crop the research at Peechelba East took quadrat cuts out of an adjacent crop of P1756 that was grown following a crop of faba beans that was terminated in October. Although results are not statistically comparable using equivalent N input from research conducted with maize on maize, the comparison revealed greater overall DM production and grain yield (18.17t/ha) where maize followed a terminated faba bean crop compared to 16.59t/ha following maize (note yields are expressed at 0% moisture in this case).

Disease Management

Two trials looking at experimental treatments based on triazole (Group 3 DMIs) and strobilurin (Group 11 QoI) fungicides produced no economic response to application and no evidence of increased green leaf retention in the maize canopy. Other than low levels of common rust *(Puccinia sorghi)* little foliar disease was observed in these trials. This two years of research work examining this aspect of agronomy research will now be discontinued and greater emphasis placed on row spacing, population and nutrition for 2022. In the maize-on-maize scenario at Peechelba East a low frequency of blackened plants was identified in the trials, but the foliar fungicides had no impact on the level of these blackened plants.