Compost has a positive impact on 2024 barley crop production

Abstract

This trial investigates the immediate effects of Van Schaik's Bio Gro standard compost (AgriGro) and a 70:30 compost–chicken manure blend (AgriGro+) on barley production in Central Victoria.

The trial demonstrated how productivity was enhanced by organic amendments, resulting in increased biomass, tillering and grain yield. Ground spread compost applications of 10 m^3/ha (approximately 6 t/ha) proved sufficient to achieve substantial plant responses, leading to grain yields increasing by 31% with AgriGro, and 20% with the AgriGro+ when compared to a control plot.

Introduction

Composting transforms organic residues into humus by utilising microbes in an aerobic environment. This high carbon content, blend of macro - and micronutrients, and diverse range of beneficial microbes make compost an effective soil amendment.

The long-term effects of integrating compost into agricultural systems includes improved soil structure, increased water holding capacity and nutrient retention. Increased plant growth and yields are seen in the same year of application with the added nutrient and microbial activity provided by the compost.

Growers have incorporated organic soil amendments into their production systems for several years, although have traditionally been limited to reliable supply, consistent product quality and agronomic cost of the input respectfully. Bio Gro's state of the art composting facility located in Newbridge, Central Victoria, is surrounded by grain, hay and livestock production systems. This close proximity to farm is crucial for increasing the use of sustainable amendments in local agricultural systems.

The aim of this trial is to determine the short-term effects of compost on barley growth and yields in central Victoria.

Materials and Methods

This trial is located 30km west of Bendigo, Victoria, on a red clay loam, characteristic of the surrounding area. Initial soil tests indicate a low pH (4.5) and elevated aluminium which can stunt root growth and reduce yields.

Figure 1 shows three one-hectare trial plots marked in 50m by 200m formations for each of the treatments; control, AgriGro (compost) and AgriGro + (70% compost and 30% chicken manure).

Figure 1. Image demonstrating the trial layout. White is the control, blue is Manure Blend, and green is AgriGro.

This paddock was prepared by chaining to break down remaining stubble on April 17th. Amendments were applied at 10m^3/ha (approximately 6t/ha) on April 23rd, then barley (*Hordeum* vulgare) was sown using a disc seeder on May 13th. Management, including fertilisers and pesticide applications were consistent across the entire subject paddock, with compost applications in the plots being the only variable.

Data collection on July 18th and August 27th provided establishment counts, fresh shoot biomass, Brix readings and Zodak growth stages for each plot.

Establishment was measured by counting all plants either side of a 50cm stick equating to the number of plants in 0.5m^2. This number is doubled to determine the quantity of plants per square metre, then an average was determined after 5 counts per plot. Fresh shoot biomasses involved removing the shoots from either side of the 50cm stick, then weighing them. The number was double to get grams per square meter with only one biomass sample collected per plot. From the plants in the biomass sample, average tiller count and Zodak's growth stage were recorded. Brix refractometer readings were taken at mid-day by taking the youngest leaves of approximately 20 plants. The sap from the sample was extracted using a garlic press and put directly onto the refractometer slide then held up to the sun to view the reading.

Yield data was collected on December 17th, when the plots were harvested. The weigh bridge at Bio Gro's Newbridge site tared a CAT Prime Mover semi tipper truck (figure 2) before a combine harvester harvested each plot. After each plot, the grain was transferred into the truck which was then weighed using the calibrated weighbridge. These weights were used to calculate yields from each one-hectare plot.

Figure 2. Truck and header used for harvest.

Results

Overview

Crop growth and development throughout the growing season was even with no significant pest, disease, or environmental impacts. Figure 3 illustrates the visually healthy barley crop at two different periods in time. Frost events around flowering had minimal effects with grain heads remaining straight and generally full. Temperatures throughout the growing season were relatively low, resulting in minimal heat stress.

Figure 3. Barley crop demonstrates even growth across the paddock. Left image taken on 26th of June 2024 and the right image taken on 3rd of August 2024.

Rainfall in 2024 was lower than average (Figure 4). Unseasonal January rain was followed by very low rainfall through February and March, the season started early with the break on April 1st. Growing season rainfall in April, May and July matched the long-term average, although June, August, September and October were all below average with June and September particularly dry.

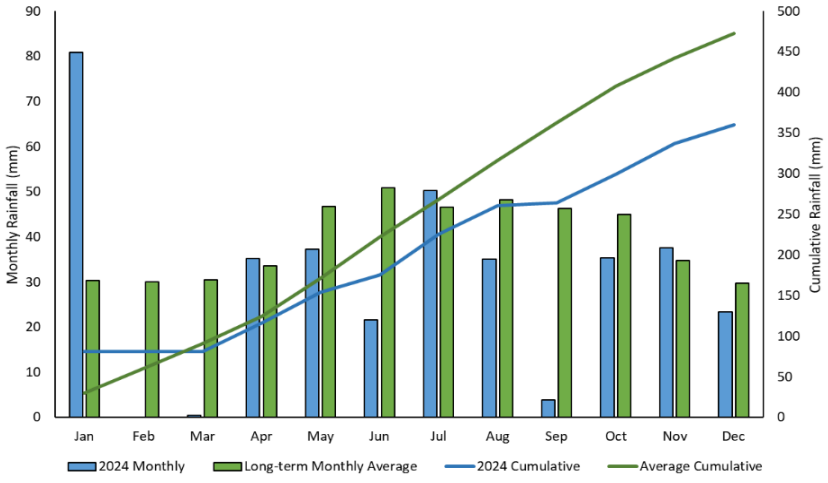

Figure 4. Monthly and cumulative rainfall for the 2024 season and the long-term average for Tarnagulla (approximately 14km from the trial site).

Plant response

Establishment counts demonstrated great variation across the paddock, ranging from 112-172 plants/m^2, but with no significant difference between treatments.

Tillers are the branches of grass plants (figure 5) and are important for increasing potential yield. Average tiller counts on July 18th were 4.5 tillers per plant for both AgriGro and AgriGro+ and 3.5 tillers per plant for the control (figure 6).

Figure 5. Image of a singular barley plant. White arrows indicate tillers whilst the blue arrow points to the main stem. This plant has 3 tillers.

Control **AgriGro** **AgriGro+**

Figure 6. This image displays the largest plants from the biomass samples in each treatment on July 18th. The AgriGro and AgriGro+ treatment have larger plants with more tillers.

The Brix of the youngest leaves for AgriGro, AgriGro+ and control were 10, 9 and 6 °Bx respectively on July 18th. By August, the Brix readings had lowered and become less varied between treatments with all treatments at 3 °Bx. All plots were tillering on July 18th with growth stages being GS23, for control and GS24 for both AgriGro and AgriGro+. By August 27th, all plots were within GS47-49.

Biomass samples followed a similar trend to the tiller counts and Brix, seeing increased biomass in the AgriGro and Manure Blend plots (figure 7). This correlation is largely expected as an increased number of tillers should result in an increased biomass. The AgriGro and AgriGro+ biomass samples collected on July 18th were 16% and 9% larger than the control, respectively which increased to 58% and 43% on August 27th.

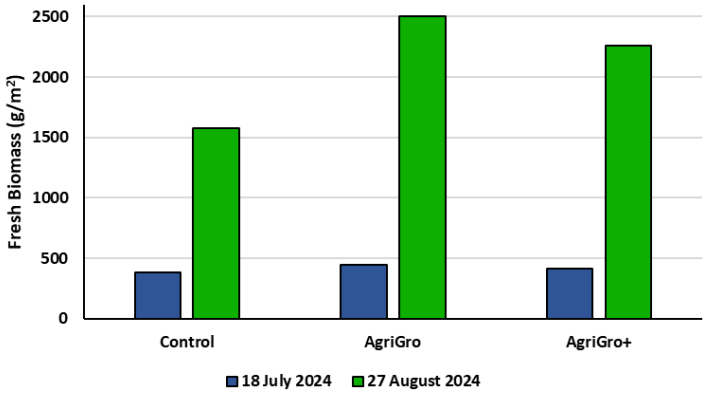

Figure 6. Average fresh biomass in grams per square metre for each treatment on July 18th and August 27th, 2024.

Yield followed the same trend as tillering, Brix and biomass such that the AgriGro and AgriGro+ treatments had an increase yield when compared to the control. Control, AgriGro and AgriGro+ reach yields of 4.40t/ha, 5.76t/ha and 5.28t/ha respectively (figure 7). This equates to increased yields of 31% for AgriGro and 20% for AgriGro+.

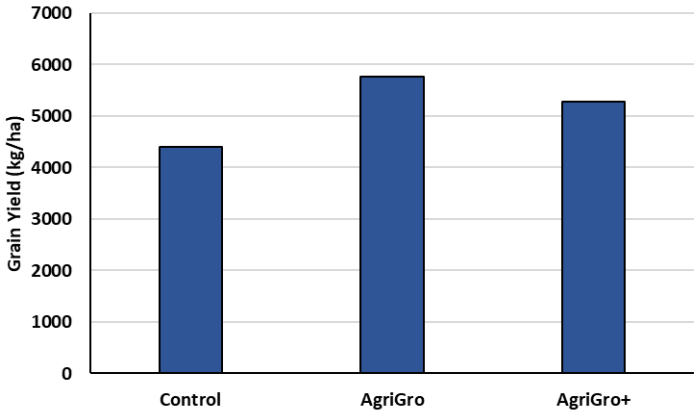

Figure 7. Barley grain yield in kilograms per hectare from each treatment plot collected on December 17th, 2024.

Table 1 The gross margins for each of the treatments where the only variable is the compost application. Increased income has been calculated from increased yields and the grower sale price of the barley at $285/t. Spreading and freight costs are not included in investment costs.

Treatment	AgriGro	AgriGro+
Increased income ($/ha)	$387.60	$250.80
Input Investment ($/ha)	$90	$270
Return on investment ($/ha)	$297.60	-$19.20

Discussion

Despite below average rainfall, crop growth persisted with good grain fill. This grower had a delayed harvest, such that rains in December potentially reduced yields with knocked off heads, as well as reducing grain quality by inducing pre-harvest germination. A falling numbers test would confirm if this occurred.

Establishment counts were varied although there was no significant difference between the treatments. Minimal variation in establishment is desired, however, no significant difference between the plots indicates consistencies of soil type, seed and sowing depth.

Early tillering was increased in the AgriGro and AgriGro+ plots. Each tiller produced early in the growing season is expected to produce a head of grain, thus more tillers mean greater yield. Tillers produced later in the growing season are unlikely to produce a head of grain, enhancing the importance of early tillering.

AgriGro and AgriGro+ had higher Brix readings in July but was less variable in August. This trail had Brix readings collected at noon although they are best collected in mid-late morning when the sun has risen and there is sufficient moisture in the soil to allow for the greatest stomatal opening. The readings collected in August, when water is less and temperatures are higher caused the stomata to close, thus reducing photosynthesis. This lowered the Brix readings and reduced variation across all plots only in the August readings. Collecting data earlier in the day may have presented different results.

Correlation between productivity markers, including tillering, biomass, Brix and yield, appears to be strong, such that plants that had greater shoot biomass simultaneously had higher Brix, more tillers and increased yield. These markers where higher in the AgriGro and AgriGro+ plots compared to the control.

Paddocks with a history of conventional cropping methods, including monocultures, cultivation, burning, fertilisers and pesticides, tend to have a reduced microbial activity within the soil. Using compost boosts the microbial activity of the soil to improve nutrient cycling and nutrient uptake to the plant. Compost also provides a blend of macro- and micronutrients. Although these nutrients are not as plentiful as those found in conventional fertilisers, the combination of nutrients provide a balanced nutrient supply. Many trace element deficiencies can be amended by incorporating compost. The 2024 season was drier than average, such that the plant response seen in the amended plots may be attributed to the increased water retention that compost provides. Further investigation is required to conclude what element of the compost increased productivity, or if the combination of microbes, nutrients and water retention are all responsible.

Conclusion

Compost addition to this crop did improve productivity. While visual inspections saw no obvious differences between treatments, sampling revealed substantial plant responses throughout the growing season. Tillering, shoot biomass and photosynthetic activity were boosted early which was followed by increased grain yields in both AgriGro and AgriGro+ treatments.

Definitively, the trial proved that there is strong return on investment for AgriGro when applied to a barley crop production system. Respectfully, AgriGro+ did not show the same agronomic response. It will be suggested that the trial is to continue across three years to determine possible longer-term benefits of both products, with a gross margin analysis conducted at the conclusion of 2026.