



## **SUMMARY OF THREE INDEPENDENT CONSECUTIVE TRIALS OF TwinN BIOFERTILISER IN STRAWBERRIES IN CALIFORNIA, 2020, 2021 & 2022**

In 2020, 2021 and 2022 Holden Research and Consulting, an independent research company, was contracted to perform formal, replicated and statistically analysed trials of the capacity of TwinN to produce high yields of strawberries when combined with a 20% reduction in nitrogen fertiliser. The trials were located on commercial strawberry farms in Ventura County, California. This report presents the results from 2022, plus summaries of the results from 2020 and 2021. Detailed reports of the 2020 and 2021 trials are available on request or on [www.mabiotec.com](http://www.mabiotec.com).

### **2020 trial summary**

See full trial report <https://www.mabiotec.com/crop-trials.php>

#### Treatments summary

- a. N, P and K fertiliser was reduced by 20% across the season (Note It is not recommended that P and K are reduced when using TwinN. Preferably only reduce N).
- b. The initial TwinN application was a root drench for 15 minutes prior to transplant. The subsequent applications were delivered via field drip irrigation system in 200 L/ha rate of non-chlorinated water.

#### Key Results

1. Yields of marketable fruit were increased by 11.7% over the season in the TwinN plots compared to the Grower Standard nutrition program.
2. Commercial returns to the grower were increased by 13.3% in the TwinN plots compared to the Grower Standard nutrition program (+\$2973/acre).

TwinN is supplied by Mapleton Agri Biotec Pty Ltd, Australia. [www.mabiotec.com](http://www.mabiotec.com)

## 2021 trial summary

See full trial report <https://www.mabiotec.com/crop-trials.php>

The 2020 trial produced significant increases in yield and returns and led to a trial in 2021 that tested two alternative application methods to confirm the recommended application method and schedule. The 2022 trial used the selected application schedule we currently recommend to commercial growers to confirm this result and to refine the method of TwinN delivery to maximise convenience to commercial growers.

### Treatments summary

- a. N, P and K fertiliser was reduced by 20% across the season (Note It is not recommended that P and K are reduced when using TwinN. Preferably only reduce N)
- b. TwinN application methods
  - i. All TwinN applications were made via fertigation
  - ii. Initial TwinN application was done by soaking seedlings roots for 50 minutes in TwinN solution before transplant and subsequent applications were made by via fertigation.

### Key Results

1. Yields of marketable fruit were increased by 9.1% and 10.5% respectively over the season for the two TwinN delivery methods compared to the Grower Standard nutrition program.
2. Commercial returns to the grower were increased by 14% and 13.6% over the season for the two TwinN delivery methods compared to the Grower Standard nutrition program (+\$3052/acre).

## 2022 trial summary

The trial was located near Somis, Ventura County, USA. It was performed by Holden Research and Consulting, an independent company. The trial was a follow-up trial after a successful TwinN trial in 2020 and 2021 in the same strawberry production area on commercial farms. Both trials compared yields and commercial returns from the standard N, P and K program versus those obtained from TwinN combined with a 20% reduction in N, P and K. The percentage increases in yields of marketable strawberries and net commercial returns for 2020, 2021 and 2022 are summarised in Table 1.

Yields were lower in 2022 than in 2020 and 2021 and the trial operator commented that the new plantings seemed 'weak at planting and never seemed to grow well'. This seemed to increase the comparative advantage of the TwinN treatments and the TwinN programs tested in 2022 produced valuable increases in yields and commercial returns compared to the standard grower program.

**Table 1. Increases in marketable yields and commercial returns to growers in TwinN programs compared to the standard grower program in 2020, 2021 and 2022**

	2020 TwinN	2021 TwinN	2022 TwinN
Marketable yield in flats per acre	11.7% increase	10.3% increase	78.5% increase
Final grower returns/acre	13.3% increase	13.6% increase (+\$3052/acre)	83.2% increase (+\$3077/acre)

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TwinN is a microbial biofertiliser produced in, and supplied from, Australia and consists of freeze-dried nitrogen fixing microbes. The microbes fix N, solubilise bound P and produce plant growth regulators. TwinN is used to increase yields and reduce synthetic nitrogen fertiliser requirements in crops. TwinN is also used to improve nitrogen nutrition in organic production systems. For information on mechanisms of action and other associated information visit <https://www.mabiotec.com/twinn.php>.

## TRIAL PROTOCOL

The variety (Fronteras) utilized for this trial was grown on the Holden Research Facility. This trial was set up as a Randomized Complete Block Design trial of two treatments with completely randomized data collection of six replicates maintained during the growing season. Plots were 2.5 ft x 14 ft. All treatments received, as a pre-plant, controlled release fertilizer and in season applications of N-P-K, along with seasonally necessitated foliar pest control. The pre-plant controlled release fertilizer application was the same across all treatments, but the in-season N-P-K was reduced to 60% of grower standard for the Twin N programs to achieve a 80% program of inputs when considered with the pre-plant 100% application of controlled release N-P-K (Total N per season on Grower Standard was 180 pounds/ac and on the TwinN was 145 pounds/ac). All materials were applied through the in field drip irrigation system. The trial was initiated 1<sup>st</sup> October 2021 and completed 9<sup>th</sup> May 2022.

### Treatment 1 Grower Standard

18-8-13 CRF Pre-plant 500 lbs/a. In season N-P-K 100% (Total N applied 180 lb/ac)

### Treatment 2 TwinN program

18-8-13 CRF Pre-plant 500 lbs/a. In season N-P-K 60% (Total N applied 145 lb/ac). Total rate of NPK across the season was a 20% reduction. (Note: Mapleton Agri Biotec recommends reduction in N but no reduction in P or K if possible). TwinN was applied via fertigation at standard per acre rate at planting and every 30 days subsequently for a total of 5 applications.

## Yield assessment

Weekly picks of marketable and unmarketable fruit commenced on 19th Jan 2022 and finalised on 9<sup>th</sup> May 2022. These were recorded, extrapolated to a per acre rate and presented per pick (Chart 1) and cumulatively (Chart 2). The commercial returns for both treatments were calculated based on USDA Shipping Point Market Prices found at [HTTP://\marketnews.usda.gov/portal](http://marketnews.usda.gov/portal) for each pick day (Chart 3).

## RESULTS

### Early growth parameters

Vigor (rated 1-5) and SPAD measurements (SPAD meters give a relative chlorophyll value) showed no significant differences between the Grower control and the TwinN treatments. Canopy percentages were measured using a Canopeo app from Oklahoma State University. The TwinN program showed a significant increase in canopy development over time compared to the Grower control. No differences occurred in early flower development between treatments.

### Brix

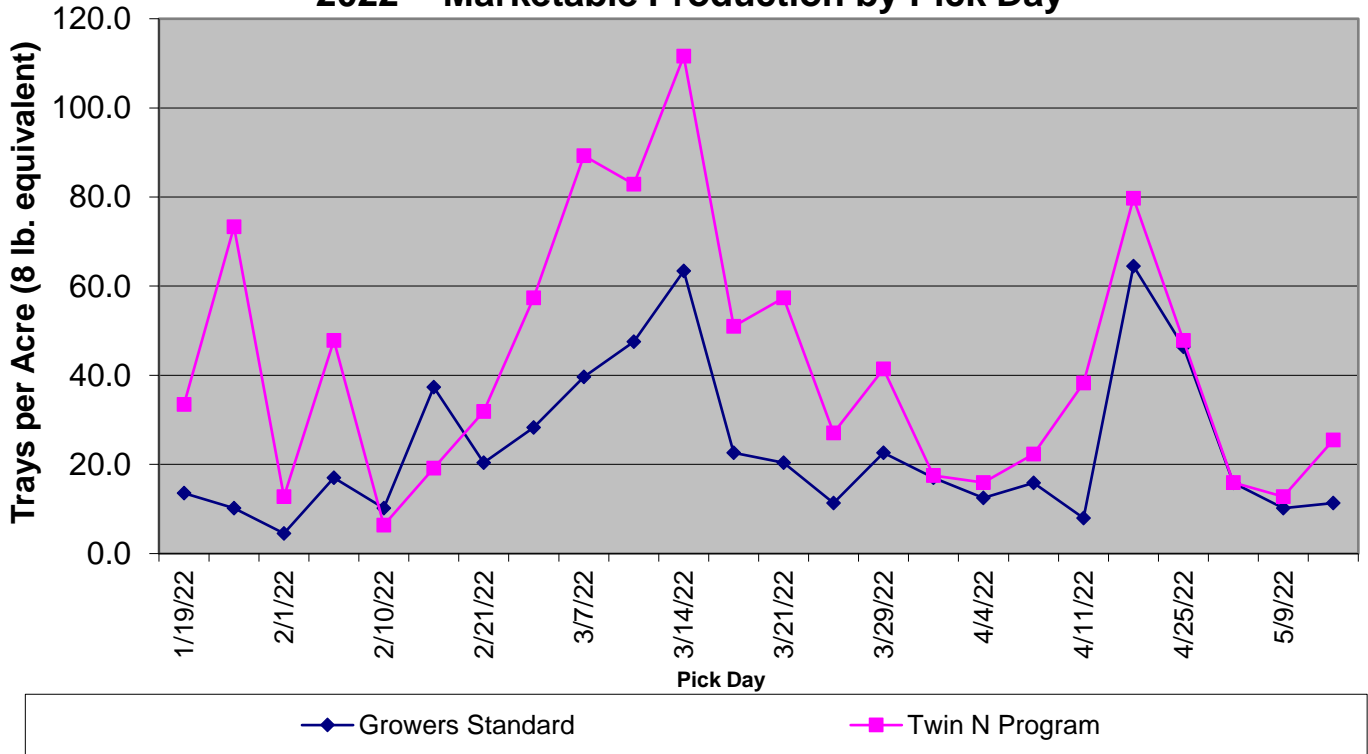
The TwinN program produced numerically higher Brix readings for four of the five measurement dates but this was not statistically significant.

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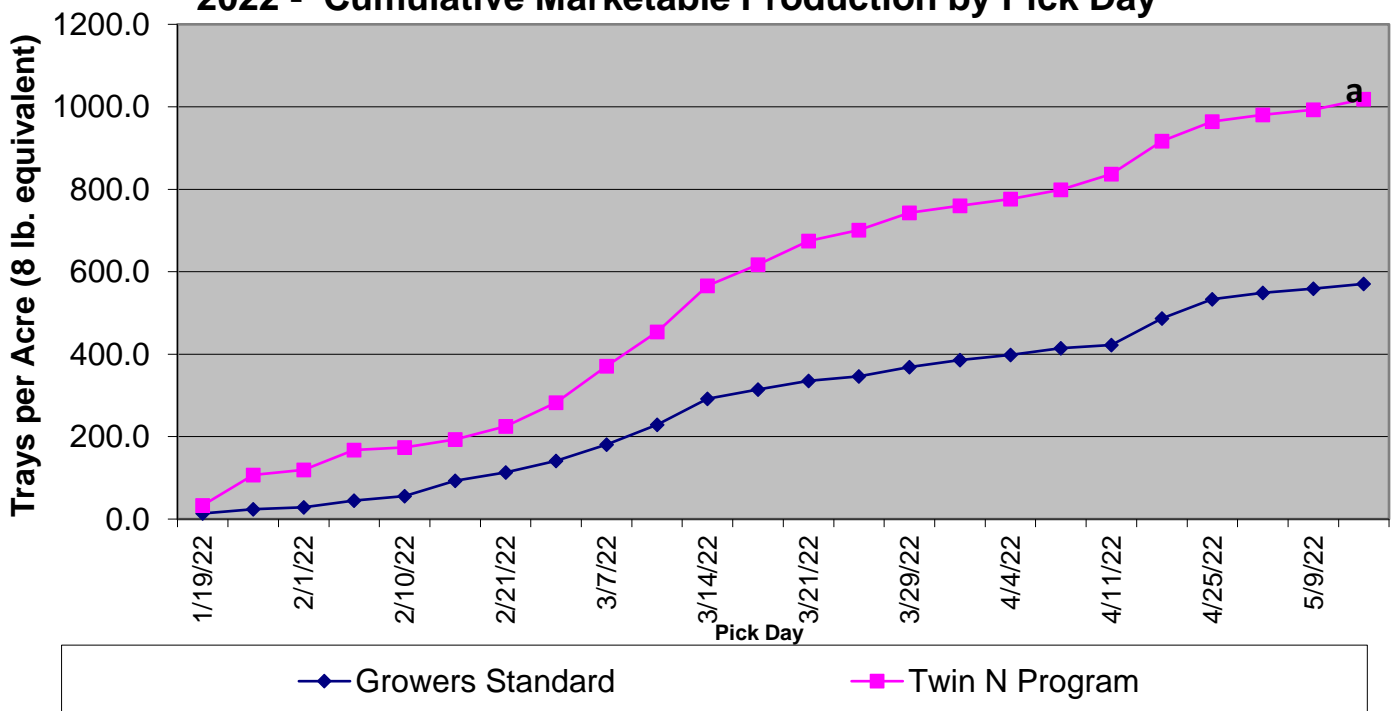
## Marketable fruit production

The TwinN program produced 1019 extrapolated flats/ac versus 571 extrapolated flats for the Grower Standard (see Charts 1 and 2). This increase is much larger than seen in 2020 and 2021 and probably reflects the fact that the crop growth was not optimal and TwinN assisted in rectifying some underlying issue.

### Chart 1: Twin N in Strawberries - Ventura County - Winter 2022 - Marketable Production by Pick Day



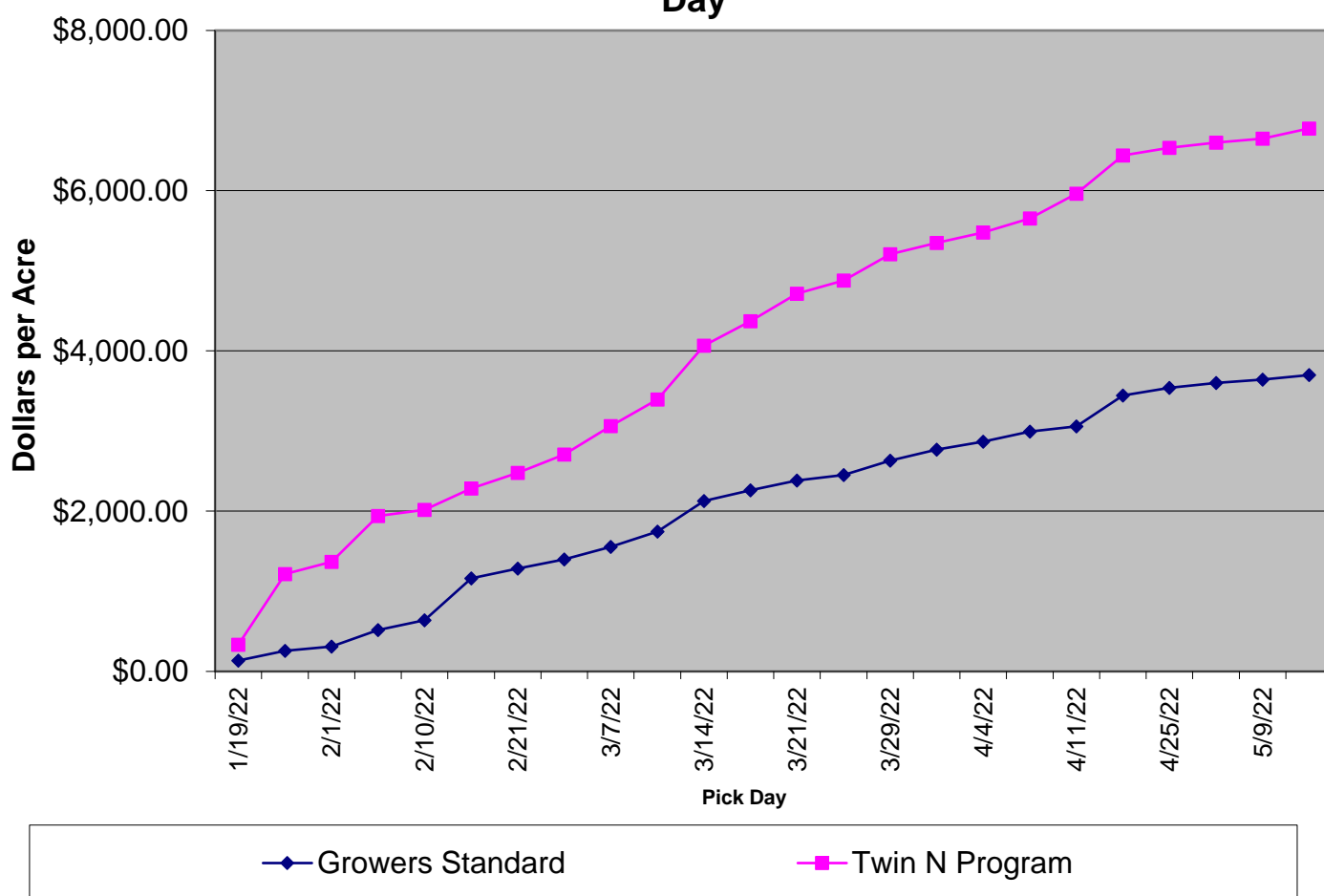
### Chart 2: Twin N in Strawberries - Ventura County - Winter 2022 - Cumulative Marketable Production by Pick Day



## Grower returns

A different perspective of how the rated production affected final grower returns is shown in Charts 3 which shows the cumulative marketable returns based on USDA Shipping Point Market Prices found at [HTTP://marketnews.usda.gov/portal](http://marketnews.usda.gov/portal) for each pick day. This data is represented as the net return back to the grower after costs of approximately \$6.00 per tray were removed that would represent picking labor, carton and tray costs, transportation to the cooler, and cooling costs associated with picking the strawberries. Based on this data, numerically cumulative seasonal return to the grower was a cumulative total of \$6777/acre for the TwinN program and \$3700/ac for the Grower Standard program alone.

**Chart 3: Twin N in Strawberries - Ventura County - Winter 2022 - Cumulative Marketable Production Net Return by Pick Day**



## Soil and leaf analyses

Early season soils report showed a base a base finding of 29 ppm nitrate-nitrogen. The next soils data taken in late December shows low amounts of nitrate-nitrogen (10 and 5 ppm) in the Grower Standard and the TwinN program. The end of season soil analysis reports similar findings shows low amounts of nitrate-nitrogen (7 and 4 ppm) in the grower standard and treatment 2. This likely reflects the documented increased capacity of TwinN treated crops to scavenge available soil nitrogen more efficiently due to increased secondary root development. The mid season leaf sample report showed very similar nitrogen levels in the leaves - about 5% higher for the TwinN program plants.

## ENVIRONMENTAL ISSUES

See <https://www.mabiotec.com/sustainability.php> for information.

- TwinN has been carbon footprint audited and is used by some companies wanting to demonstrate reduced C footprint for their produce/products via reduced synthetic N inputs (which have a very high C footprint)
- TwinN is certified organic
- TwinN reduces leaching of nitrates into aquifers and waterways via reduced nitrogen application rates and improved capture of applied nitrogen fertiliser

## CONCLUSION

The 2022 trial was the third consecutive trial of TwinN in commercial strawberry cultivars showing very significant increases in marketable production from the recommended TwinN program compared to the Grower Standard. This led to a substantial increase in returns to the grower.

SEE COMMERCIAL GROWER RECOMMENDATIONS OVER PAGE

## COMMERCIAL GROWER RECOMMENDATIONS

These are some guidelines for use of TwinN in strawberry production.

- Apply the pre-plant fertiliser at standard rates
- Reduce in-crop nitrogen fertiliser to 60 - 70% of the standard rate to give an overall cut in N of 20%
- Make reductions to N as evenly across the season as possible
- If possible do not cut other nutrients such as P and K
- If TwinN is being applied in organic strawberry crops (TwinN is OMRI certified) do not reduce any organic nutrients. Apply TwinN on top of the organic nutrition program.
- Apply TwinN to the crop via fertigation immediately after transplant to speed early root growth and establishment
- Apply TwinN another four times spreading the five applications evenly across the season
- Apply via fertigation. Be sure to avoid doing applications during hot sunny periods if there is a risk that black plastic irrigation lines can become hot in the direct sun.
- Do not co-apply TwinN microbes with agrochemicals including fertilisers. Avoid applying these for at least 24hrs before and after the TwinN application.
- Ensure the irrigation lines are free of agrochemicals before TwinN application
- Do not expose the TwinN microbes to chlorinated water during application. Chlorinated water can be used for the crop after the TwinN application is complete.
- If only chlorinated water is available for application of TwinN de-chlorinate with sodium thiosulfate (STS). See [www.mabiotec.com](http://www.mabiotec.com) for instructions or contact your distributor. For organic methods to de-chlorinate see [www.mabiotec.com](http://www.mabiotec.com).



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