

Final report on the effects of Summa Grow's product on growth, development and yield (Bushels/acre) of soybeans (*Glycine max*) during 2016 growing season

by

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Abstract: Biological entities have long been shown to positively affect growth and development of plants and improve yield by improving the environment they are growing under. Generally, the soils that crops are produced in have been mono-cropped for many years rendering these soils void of natural soil borne organisms known to function synergistically to improve nutrient and water uptake in the rhizosphere. Summa Grow is such a biological product that has been shown to improve fertilizer uptake naturally occurring in the soil and reduce rates of synthetic fertilizers necessary to secure adequate yields. In 2016, Pioneer 54T94 soybeans grown in soils of high clay content were treated with Summa Grow at 1.0 gallons per acre with varying responses. Summa Grow (one or two applications following emergence) with 70.0% or 100.0% of the recommended fertilizer rates via soil analysis improved yields over the grower standard and untreated check. However, growth stages were delayed in the 70% fertilizer treatments while they still provided greater rates of growth. In addition, all Summa Grow treatments had greater growth compared to the untreated check.

Objective: To further gather information on the effects of Summa Grow applied to soybean foliage at different growth stages with full and reduced fertilizer rates to determine if Summa Grow improves the plant's efficacy of fertilizer uptake and if in doing so could reduce the recommended fertilizer rate.

Materials and Methods: On June 6, 2016, Pioneer 54T94 was planted at the LSU AgCenter in St. Joseph Louisiana into a heavy clay soil with a Cation Exchange Capacity greater than 21.0 meq/100g. This site was planted to soybeans in 2015 making two successive crops of soybeans. Soil samples were randomly taken at the site using a hand-held probe to a depth of 6.0 inches and the analysis was conducted at Waypoint Analytical in Memphis, TN prior to planting to determine the nutritional levels of the soil and determine fertilizer rates. Analysis results indicated low P₂O₅ and K₂O levels requiring 54.0 and 84.0 actual pounds per acre respectively. These rates assumed a 50.0 bu/acre yield potential. It further indicated that the soil pH was 6.5 and required no need for lime with a soil organic matter level of 1.2%.

Planting was conducted using a four row John Deere air planter set for 40.0 inch rows and to deliver 7.0 to 8.0 seed per linear foot at a planting depth of 1.5 inches deep. Planting occurred onto previously established beds and weeds had been chemically controlled two weeks prior to planting.

Individual plot size were two 40.0 inch rows or 6.66 feet wide and 30.0 feet long equaling 199.99 square feet or 0.0045 acres per plot. Experimental design was a Randomized Completer Block consisting of four replications and treatments were as follows.

Treatment list for effects of Summa Grow on fertilizer use and soybean production.

Treatment Number	Treatment	Rate per acre
1	Untreated Check	0
2	Grower Standard	60.0 Lbs P2O5 + 90.0 Lbs K2O
3	100 % Recommended Fertilizer + Summa Grow (1)	54.0 Lbs P2O5 + 84.0 Lbs K2O + 1.0 gal
4	70% Recommended Fertilizer + Summa Grow (1)	37.8 Lbs P2O5 + 51.0 Lbs K2O + 1.0 gal
5	70% Recommended Fertilizer + Summa Grow (2)	37.8 Lbs P2O5 + 51.0 Lbs K2O + 1.0 gal + 1.0 gal
6	Summa Grow <i>fb</i> Summa Grow <i>fb</i> Summa Grow	1.0 gal + 1.0 gal + 1.0 gal

^z (1) indicates that only one application of Summa Grow was applied and (2) denotes two applications were made.

^y Fertilizer applied to plots using a hand-held fertilizer spreader.

^x Summa Grow applied using a CO2 back pack sprayer calibrated to deliver 15.0 gallons per acre of water.

Fertilizer was previously weighed using digital gram scales to equate the correct amount of each nutrient to deliver per plot on an acre basis was bagged the previous day, kept dry and then applied on a per plot basis using a hand-held spreader prior to planting. Next the planting process occurred and the first application of Summa Grow was applied to the soil using a CO2 sprayer calibrated to deliver 15.0 gallons of water per acre. A second application was applied 30 days after planting (Growth Stage of Vegetative 5.0) to those plots determined to obtain a second application and a third application was made 65 days after planting (Growth Stage was Reproductive 1.0 to 2.0) to treatment six.

Two evaluation periods occurred at 65 days after planting (Reproductive) and the 150 days after planting (Harvest). The criteria for evaluation at 65 days after planting included plant height, total nodes above the cotyledons, and growth stage. At harvest, evaluation included plant height in inches, lodging and shatter on a scale of 1.0 to 5.0 where 1.0 had the least degree of lodging and shatter while 5.0 had the greatest degree. In addition, harvest was conducted using a small plot combine equipped with scales and moisture meters and pounds per plot and moisture was recorded.

Results and Discussion

65 Days following planting. Plant height was increased using 70% of the recommended fertilizer rate with Summa Grow at 1.0 gallon per acre rate (Table 1.0) when compared to the grower standard or untreated check. In addition, all Summa Grow treatments increased plant height over the untreated check numerically and increased total node numbers by one node per plant when compared to the untreated check and grower standard. Unlike plant height, the 70% fertilizer treatment with Summa Grow reduced the plant growth stage (Table 2.0) below the grower standard but they were numerically greater than the untreated check. This could be due to the enhanced growth shown by these treatments and increased number of nodes making the results due to improved plant health.

150 days following planting. At 150 days following planting, the Summa Grow product provided increased plant height compared to the grower standard or untreated check (Table 3.0). A height increase of approximately 4.0 inches was obtained using the Summa Grow product even after reducing the recommended fertilizer rate by to 70% of recommended. This was further manifested in plant height differences (Table 4.0) where all Summa Grow treatments had greater plant height differences between

the evaluation periods of 65 and 150 days after planting compared to the grower standard and untreated check indicating greater continued growth despite reduction in fertilizer rates below what was recommended. Shatter (one to five) was greatest in untreated check, grower standard and 100% recommended fertilizer plus Summa Grow treatments (Table 3.0) which related to growth stage evaluation at 65 days following planting (Table 5.0) with exception to the untreated check. Granted, shatter was relatively low during 2016 growing season but can account for significant loss of yield. This further indicates that treatments maturing early require timely harvest to avoid high levels of shatter. For the most part, Summa Grow treatments improved growth thereby delaying maturity and reduced degrees of shatter. Soybean yield was improved using the Summa Grow product (Table 3.0 and Figure 1.0) despite the reduction of recommended fertilizer rates. Yield increases ranged from a 7.0 to 10.0 bushel per acre increase on the high side when compared to untreated check and grower standard.

Conclusion

Summa Grow at 1.0 gallons per acre did positively improve soybean performance (growth and yield) in low P2O5 and K2O soils despite having the recommended fertilizer rate reduced by 30%. This indicates that properly used, bio-stimulants can improve plant health and thereby improve yield. Even where no fertilizer was used, Summa Grow increased yield and performance of soybeans during 2016. This indicates that plant health improvement can improve crop performance in low nutrient testing soils and Summa Grow as a soil and foliar treatment improved plant health in 2016.

Tables and Figures

Table 1.0. Effects of Summa Grow and fertilizer on growth (plant height and total nodes) of soybeans at 65 days after planting.

Treatment Name	Plant Height (")	Total Nodes	Ht:Node Ratio (")
70% Fert + Summa Grow (1)	25.82	13.54	1.91
70% Fert + Summa Grow (2)	25.24	13.33	1.89
Grower Standard	24.92	12.54	1.99
Summa Grow (3)	24.63	13.52	1.82
100% Fert + Summa Grow (1)	24.21	13.08	1.85
UTC	23.88	12.41	1.92

^Z Height to Node Ratio was extrapolated by dividing plant height by total nodes.

^Y Five plants per plot were sampled.

^X (1) means only one Summa Grow treatment was applied at 1.0 gallons per acre and (2 & 3) carried same meaning.

^W Fert=Fertilizer.

Table 2.0. Effects of Summa Grow and fertilizer on growth (reproductive growth stage) of soybeans at 65 days after planting.

Treatment Name	Reproductive Growth Stage
100% Fert + Summa Grow	1.68
Grower Standard	1.60
Summa Grow (3)	1.46
70% Fert + Summa Grow (2)	1.38
70% Fert + Summa Grow (1)	1.36
UTC	1.28

^z Five plants per plot were sampled.

^y (1) means only one Summa Grow treatment was applied at 1.0 gallons per acre and (2 & 3) carried same meaning.

^x Fert=Fertilizer.

Table 3.0. Effects of Summa Grow and fertilizer on soybean growth, stability and yield (Bu/ac)

Treatment	Plant Height (")	Lodging (1-5)	Shatter (1-5)	Grain Moisture (%)	Bu/ac
70% Fert + Summa Grow (2)	44.50	1.50	1.13	11.70	58.13
100% Fert + Summa Grow	45.00	1.13	1.50	11.78	54.79
70% Fert + Summa Grow (1)	45.50	1.13	1.13	11.60	53.13
Summa Grow (3)	44.00	1.38	1.18	11.53	52.43
Grower Standard	41.50	1.25	1.50	11.56	51.45
UTC	40.25	1.38	1.63	11.73	48.44

^z Plant height was conducted by measurements from soil line to terminal in inches.

^y Lodging and shatter was conducted in subjective manner visually and based on scale of one to five where one had lowest degree of shatter and lodging.

^x Grain moisture was obtained via combine moisture meter.

^w (1) means only one Summa Grow treatment was applied at 1.0 gallons per acre and (2 & 3) carried same meaning.

^v Fert=Fertilizer.

Table 4.0. Plant height (") difference show casing plant growth from 65 to 150 days after planting.

Treatment	Plant Height (") 65 DAP	Plant Height (") 150 DAP	Plant Height Difference (")
70% Fert + Summa Grow (2)	25.24	44.50	19.26
100% Fert + Summa Grow	24.21	45.00	20.80
70% Fert + Summa Grow (1)	25.82	45.50	19.68
Summa Grow (3)	24.63	44.00	19.37
Grower Standard	24.92	41.50	16.58
UTC	23.88	40.25	16.37

^Z Plant height difference was extrapolated by subtracting plant height at 65 DAP from plant height at 150 DAP.

^Y (1) means only one Summa Grow treatment was applied at 1.0 gallons per acre and (2 & 3) carried same meaning.

^X Fert=Fertilizer.

Table 5.0. Comparison of grain shatter at 150 DAP to growth stage at 65 DAP.

Treatment	Shatter (1-5) 150 DAP	Growth Stage (65 DAP)
70% Fert + Summa Grow (2)	1.13	1.38
100% Fert + Summa Grow	1.50	1.68
70% Fert + Summa Grow (1)	1.13	1.36
Summa Grow (3)	1.18	1.46
Grower Standard	1.50	1.60
UTC	1.63	1.28

^Z Shatter was conducted in subjective manner visually and based on scale of one to five where one had lowest degree of shatter.

^Y (1) means only one Summa Grow treatment was applied at 1.0 gallons per acre and (2 & 3) carried same meaning.

^X Fert=Fertilizer.

Figure 1.0. Summa Grow and fertilizer effect on soybean yield in bushels per acre.

