VARIABLE RATE SEEDING IN COTTON

G. Kyle Smith
Michael T. Plumblee
Kendall R. Kirk
Clemson University
Blackville, SC

Abstract

Over the last decade, the adoption and availability of planter technologies have increased across farms in the Southeastern United States providing growers the ability to precisely place seed in areas of the field that they desire. Furthermore, benefits of using planter technologies appear to have some benefit in other crops commonly grown in rotation with cotton such as corn and soybean. Cottonseed typically makes up 15-20% of the total input cost for cotton production. With the current price of commodities and input costs continuing to rise, annual profit margins are likely tight. For growers to remain competitive and profitable, areas within their current production systems must be evaluated to determine costs that can be reduced. Previous research by Gwathmey *et al.* (2010) demonstrated that cotton lint yield could be maintained at plant populations as low as 30,000 plants per acre. Therefore, the objective of this research was to determine if variable rate seeding in cotton could reduce seed cost while maintaining lint yield. An experiment was conducted in 2017, 2019, 2020, and 2021 at the Edisto Research and Education Center in Blackville, SC to evaluate variable rate seeding in cotton and to test the Directed Rx variable rate prescription development method. Electrical conductivity (EC) data was collected prior to planting with a Veris 3100 EC cart.

Introduction

Cotton growers in South Carolina are in need of ways to reduce input costs in years where profit margins are tight. Seed costs for cotton producers can range from $200 to $300 per hectare depending on seed price and seeding rate. With seed alone accounting for 15-20% of total input cost, reducing seeding rates could save growers money. Research conducted by Gwathmey *et al*. (2010) demonstrated that seeding cotton at rates ranging from 74,000 to 111,000 seed per hectare had no effect on profit. With new precision planter capabilities coupled with variable rate prescriptions could provide an opportunity to vary seeding rate across fields to reduce seed.

Throughout the southeastern USA, cotton (*Gossypium hirsutum* L.) is an important commodity. In South Carolina, cotton contributed on average $150 million in 2017 to the economy on approximately 95,000 hectares from 2008-2018 (NASS, 2018). Cotton, an indeterminate crop, has the ability to compensate for varying plant stands better than other crops such as corn (*Zea mays* L.). However, reducing seeding rate could lead to decreases in yield and profit in certain environmental conditions. Although technology provides growers with variable rate capabilities it is essential for variable rate prescriptions to be developed using a science-based repeatable method to ensure yield and profit is maximized.

Materials and Methods

An experiment was conducted in 2017, 2019, 2020, and 2021 at the Edisto Research and Education Center in Blackville, SC to evaluate variable rate seeding in cotton and to test the Directed Rx variable rate prescription method. Shallow electrical conductivity (EC) data was collected prior to planting using a Veris 3100 EC cart. Deltapine 1646 B2XF was planted each year of the experiment in 4-row strip plots at 6 uniform seeding rates in an irrigated field. Each treatment was replicated six times across the field in a randomized complete block design. Uniform seeding rates consisted of 50,966, 67,955, 84,941, 101,929, 118,918, and 135,907 seed per hectare. All treatments were planted with a 4-row John Deere 1700 planter with Precision Planting vDrive, vSet2, and singulated cotton seed disk. Yield was collected using a John Deere 9996 cotton picker with a yield monitor, Data collected in 2017 and 2020 allowed for the variable rate prescriptions to be created using the Clemson Directed Rx method and this variable rate prescription was applied in strips in 2019 in field E7B and the 2021 prescription was applied in strips in field C8B for comparison purposes. Both fields consist of highly variable soils and located at the Edisto REC. Data were subjected to analysis of variance using the PROC Glimmix procedure in SAS v9.4 and multiple pairwise t-tests were used to separate means at $p = 0.05$.

Results and Discussion

Among the uniform seeding rates, 118,918 seed/ha provided the greatest return above seed cost which does agree with Bridge *et al.* (1973) in which seeding rates of 118,000 seed/ha maximize yield. Looking at the overall cost of seed, the seed cost for the 2017 variable rate prescription was significantly less than that for the most profitable uniform seeding rate of 118,918 seed/ha. The projected profit in 2019 for the application of the 2017 Shallow EC variable rate prescription was not significantly different from the best performing uniform rate. The projected profit in 2019 for the application of the 2017 Shallow EC variable rate prescription was also not significantly different from the actual profit from the applied prescription. In 2019, variable rate seeding in cotton does show the potential to profit $34/ha over any other uniform seeding rate, had the correct prescription been applied. In 2020, the return above variable input costs did have significant difference among the uniform seeding rates and the prescription with the prescription showing the most potential profit. The overall response and benefit of variable rate seeding in cotton production likely varies on a field-by-field basis with regard to the soil texture variability that exists withing the field.

Summary

Variable rate seeding in cotton has the potential to increase grower profitability on a field-to-field basis. Continued research is needed to understand how zones should be delineated based on field activity. Additional data needs to be collected to understand the interaction between weather, variety, field, soil texture, etc. to optimize prescription development. The Clemson Directed Rx method does appear to be an appropriate, repeatable, method to use to develop variable rate prescriptions. Some future research does need to be conducted. Continuing to evaluate the Clemson Directed Rx method and variable rate seeding in cotton across multiple fields with varying levels of soil texture variability is needed. Also, the evaluation of different cotton cultivars and seed sizes and their response to variable rate seeding needs to be address.

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