Introducing Drone Technology for Precise Agricultural Cotton Production

Background

Cotton, the most important fiber crop in the world, plays a significant role in the economics of many countries. In the crop year 2020/2021,[1] China, India, and the United States ranked as the top three producers of cotton. China ranked second behind Australia in average yield – 1,879 kg per hectare. High yield is not only due to a high mechanization rate but also precise management by cotton farmers. Cotton farmers make many decisions across the growing season – sowing, reseeding, fertilization, growth regulation, pesticide spraying, defoliant application, etc.

In order to improve crop scouting efficiency, reduce chemical usage, and boost yield, cotton farmers in China's Xinjiang Province are adopting drone technology in both field scouting and chemical application.

The Mission

Gongxu Chen is a cotton farmer in Xinjiang, China, who manages 300ha of cotton fields. Formerly, in order to optimize yield, he applied Mepiquat chloride, a chemical used as a growth regulator in cotton, 6-7 times in one growing season to tune the height and canopy of the cotton plants. Before each application, Gongxu walked the field on foot and selected around three sample locations in every ten hectares to take individual height measurements. This year, he used DJI's P4 Multispectral drone to help with field scouting. In one 25-minute flight, the P4 Multispectral drone captured 45 hectares of imagery. The imagery was post-processed in DJI Terra software to generate RGB mapping and vegetation indices, including NDVI. In less than one day, Gongxu received an NDVI growth map of his 300ha cotton farm, showing the growth variation of the whole field. With this map, Gongxu was able to segment his fields into growth zones and strategically place sampling locations for further inspection.

[1] https://www.statista.com/statistics/263055/cotton-production-worldwide-by-top-countries/

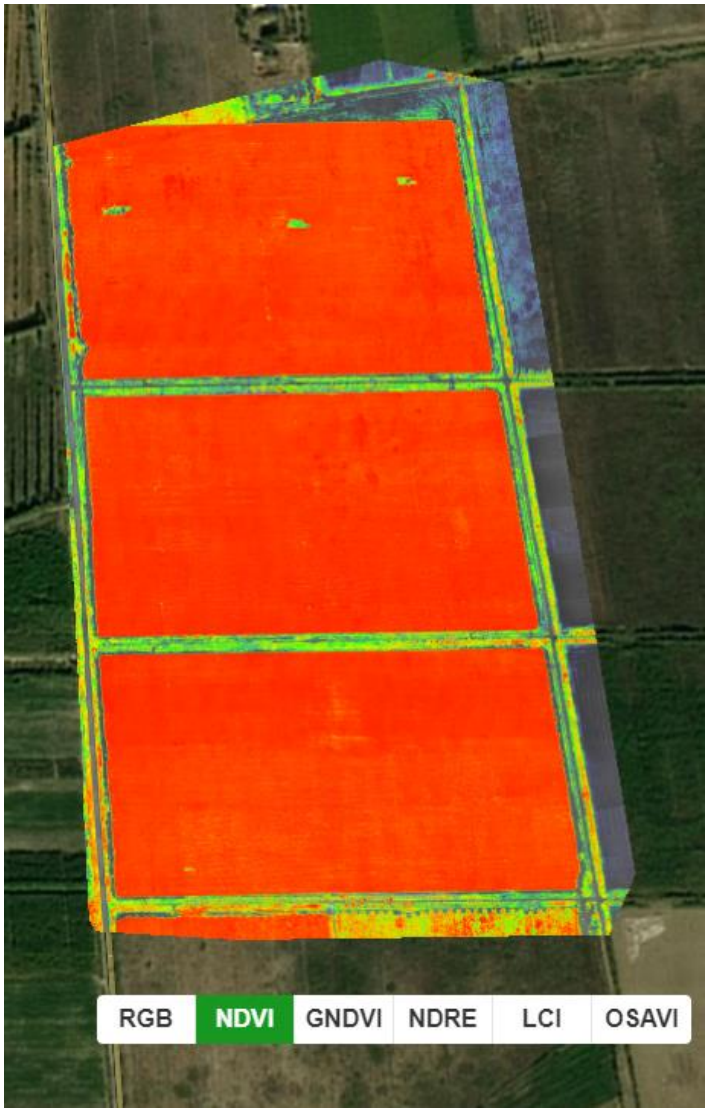
RGB imagery and NDVI map of 45ha cotton fields

An NDVI map is also used for precise spraying. Based on the NDVI map, Gongxu modified his regular flat-rate application method to variable rate application (VRA) by generating a Mepiquat chloride prescription map in which only the area with over-growth was assigned a spraying rate while the rest were left as non-spray. This prescription map was then downloaded to the DJI Agras T30 drone for execution.

Prescription map of Mepiquat chloride

T30 in mission

Similarly, in the later growth stage, Gongxu generated a VRA prescription for foliar fertilization to boost the growth of the weaker regions and improve the homogeneity of the field.



Improved field homogeneity after VRA, as shown by an NDVI map

Conclusion

Gongxu was satisfied and felt that the outcome justified the investment in multispectral and spraying drones – not only was chemical usage reduced by 30%, the cotton yield was also increased by 450 kg per hectare in the crop year of 2021. Additionally, when it comes to crop scouting, Gongxu no longer has to choose between precision and efficiency.

The success of new technology adoption interests cotton farmers in the region. Gongxu plans to expand his business to provide precision agriculture services to neighboring farms, scouting cotton fields using P4 Multispectral and offering variable rate application with Agras drones. In his world, “Investment in drone technology clearly improves yield potential and reduces farming costs. By providing services, more farmers can benefit from innovative precision agriculture solutions.”