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What do you get from an NDVI reading?

This time of year as we approach mid-season or panicle initiation, farmers are increasing using Normalized Difference Vegetative Index (NDVI) to access their crop. What is NDVI and what can it tell you? Below I have taken some text from an Iowa State website (<https://crops.extension.iastate.edu>) that discusses NDVI. In brief, NDVI is a good source of information to evaluate variation in crop vigor over a field and identify management zones BUT scouting is still necessary to determine the cause of the variation you may be seeing.

NDVI is a calculated index used to monitor crop health and photosynthetic activity. The higher the index value the greater the crop vigor. A color gradient is applied to make the image easier to interpret. A commonly used gradient is red to green; red being the low values and green being the high. Typically four colors are used with each representing approximately 25% of the field. This is similar to how a yield map represents data.

- *One of the simplest indices, commonly provided by imagery providers as part of a standard imagery package.*
- *Two different types of NDVI image: Calibrated and Uncalibrated/Maximum Variation Scaling.*
 - *Calibrated NDVI images can be used to show changes in vegetation due to*

management systems or other factors over time.

- *Uncalibrated or Maximum Variation NDVI images can be used to show crop vigor at a particular point in time. It's the most common type currently provided by imagery providers.*
- *Typical Uses: NDVI imagery has been widely used to assess crop vigor across a field, areas of ponding and changes in field conditions over time.*

NDVI maps show variability in crop vigor in greater detail than a standard color image. Color scaling for the NDVI map does need to be considered when making recommendations based on the imagery. Uncalibrated NDVI which is the most common form will always results in areas of red and green within the field, even if the entire field is relatively strong or relatively poor. As a result, NDVI is a good information source for quickly evaluating different production zones or artifacts within a field but scouting is still required to assess the magnitude and cause of the variability.

The above is from Iowa State, now back to California. In order to determine if low NDVI is the result of low crop nitrogen (N), we recommend a crop assessment at panicle initiation (PI - about 45-55 days after planting. Determination of an N deficiency is most easily accomplished by comparing the field NDVI to the NDVI of an N enriched strip (an area that you are certain is not N deficient as extra N fertilizer was applied). If you did not do this, areas with an aqua overlap may be used. You may be able to see this on your NDVI map and compare areas with extra N to the rest of the field. That will help you access whether or not you are looking at an N deficiency.

While the Green Seeker does not generate a map, it is a valuable tool that we have been testing for this purpose. It has an active NDVI sensor that measures the NDVI of the canopy. Based on preliminary data, we have developed a response index to help growers decide when a top-dress N application is necessary. We have found that an index of 1.1 or greater indicates the need for top-dress N application. The response index is the NDVI reading of an enriched N

strip (representing a crop with unlimited N) divided by the NDVI reading from the field test area. The N enriched strip is an area where extra N was added to the field (could be done by overlapping an area with an aqua rig). For example if the N enriched strip gave an NDVI value of 78 and the field test area gave an NDVI value of 68, the response index would be 1.14 ($78/68=1.15$) and this would indicate the need for a top-dress N application.

We would like to emphasize that this is based on preliminary data and further testing may change the response index. However, for now it does provide a useful guide. Some limitations to the Green Seeker are that it is still relatively limited in area that can be tested; although it is much faster to take readings and therefore get a better assessment of the field. You can also not use the Green Seeker when leaves have dew or rainfall on them. The Green Seeker also does not work well where there is poor stand establishment or a high amount of weeds.

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Effect of armyworm defoliation on rice yield

Since the armyworm outbreak in 2015, the worms seem to have decided to come back every year and cause problems. This year the rice industry is ready, with Intrepid already available for growers in case they need to do a treatment. Dimilin is also a good option. I would discourage the use of pyrethroids, even applied early when the worms are small. Pyrethroid efficacy is limited, and because they are broad spectrum, their use might result in killing more natural enemies than worms.

Armyworm defoliation and damage to the panicle can result in yield reduction. In the past four years, armyworm research has focused on the effect of defoliation. A survey of growers affected by the 2015 outbreak showed that yield

reductions ranged from 4 to 12%, but losses as high as 24% were reported. A second survey conducted in 2016 and 2017 showed an average yield reduction for affected growers of 3.5%, but those that used only a pyrethroid averaged 6% yield reduction. Last year, defoliation studies were conducted to get a better idea of the true effect of armyworm defoliation on rice growth and yield. Because it is difficult to set up trials with real armyworms in the field, we artificially defoliated the rice during several days to mimic what armyworms do in the field.

When rice was defoliated 25%, plants recovered and there was no difference on plant height at harvest (lines red and blue in fig. 1A). When plants were defoliated 50%, they were noticeably

shorter at harvest, but the difference with the control was small (green line in fig. 1A). Plants that were defoliated to the water line were significantly shorter at harvest (orange line in fig.

1A). The effect on heading was similar, with a delay to reach 100% heading on plants defoliated 100% of about 12 days.

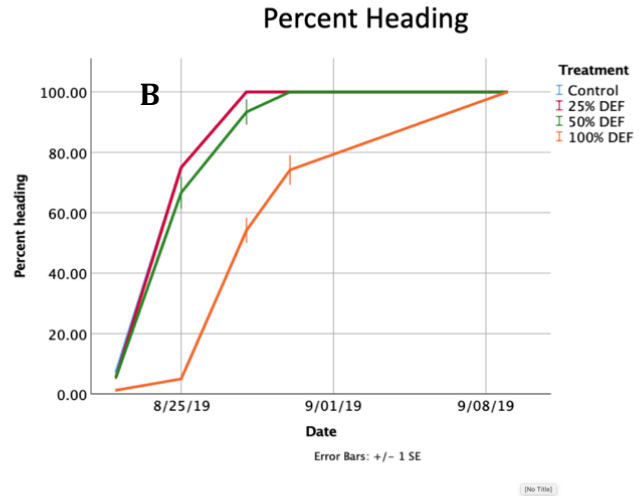
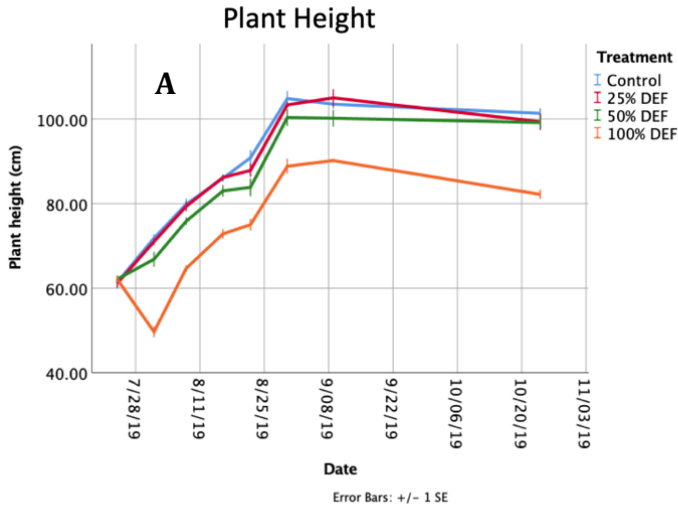


Fig. 1. Effect of defoliation (DEF) above the water line on plant height at harvest (A) and percentage heading (B).

The most striking effect was on yield. Plants that were defoliated 100% had a 25% yield loss. That corroborates what was reported in 2015. Defoliating 25 or 50% of foliage did not result in yield loss. However, the field where the trial was conducted was planted late, and therefore the yield was not great. Given the noticeable effect on plant height and heading when defoliating 50%, there could be an effect on yield if the field would have been planted earlier. We are repeating this experiment again, with a better planting date. Overall, this trial seems to confirm the guidelines for growers about defoliation. If armyworm defoliation is 25%, a treatment is needed to avoid yield reduction.

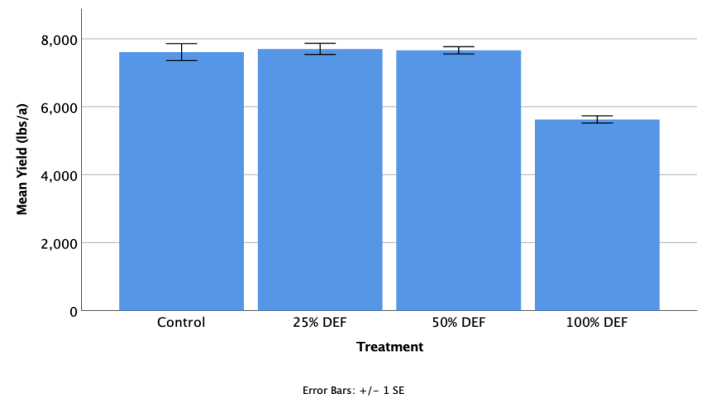


Fig. 2. Effect of defoliation (DEF) above the water line on grain yield.

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New California Rice Herbicide Available in 2020: RebelEX

A new herbicide is available this year for use in California rice: RebelEX®, manufactured by Corteva. It is a premix of two other well-known herbicides: Clincher® and Granite SC®, both from Corteva. The active ingredients in RebelEX® are cyhalofop (same as Clincher®) and penoxsulam (same as Granite SC®). Since it contains cyhalofop, it is important to check with your respective counties on the buffer zones and aerial application restrictions for Clincher®, as the same zones will apply.

The labeled weeds that RebelEX® controls are sprangletop, watergrass (both early and late), barnyardgrass, ricefield bulrush, Monochoria, redstem, ducksalad, California arrowhead, and water plantain. It does not have a water-holding period. The application timing begins from when the rice has one leaf or more, up to 60 days before harvest. Efficacy, as with most products, is better when the weeds are smaller. For flooded fields, it is important to have maximum contact, so it is recommended to lower the water in the field until at least 70% of the weed biomass is exposed, before application.

The product is “rainfast” (meaning it isn’t affected by water) within 2 hours, so reflooding quickly is recommended. The label recommends restarting the flood at 3 hours after application, and to have the field completely reflooded within 24 to 48 hours at a maximum. Long drainage periods can encourage additional germination of certain weed species, including smallflower umbrella sedge, watergrass, barnyardgrass, and sprangletop.

Since RebelEX® also contains penoxsulam, it cannot be applied in the same season as Granite GR® or Granite SC®. Doing so will cause significant phytotoxicity to the rice, and will likely impact yields. Clincher® can be applied in the same season, but depending on the rate of RebelEX® applied, the Clincher® application rates will vary, so please refer to the label for

rates and timings if planning to also apply both herbicides in the same season. For management of resistance, however, it is not recommended to apply Clincher® and RebelEX® in the same season, as both contain the same active ingredient, cyhalofop. Repeated applications of the same active ingredient (cyhalofop) will select for resistance in sprangletop, barnyardgrass, and watergrass (both late and early).

Remember to always follow all label instructions when applying any pesticide, as the label is the law. Consult your local Agricultural Commissioner’s Office regarding buffer zones and aerial restrictions, before making any applications.

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