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USING PHOTOGRAPHY FOR MAKING REPLANT DECISIONS

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Abstract

Digital photography is a tool that can be used for making crop replant decisions quickly. Live tissue reflects more infrared light than dead tissue. This can be observed using infrared film with a yellow filter. The live tissue is red and the rest is a blue or a muted color. Replant decisions must be made quickly and infrared film can take as much as a week to be processed. Decisions need to be made quickly, so film development time is critical. A digital camera virtually eliminates all of the development time by allowing the photos to be processed in the field on a laptop computer. A photo that mimics an infrared photo can be seen within five minutes. With only three or less steps, changing hue and saturation each time, the photos can be modified to produce the desired result, which takes less than 5 minutes. The photos are then ready for interpetion so replant decisions can be made. The healthy tissue is a bright red. Plants that appear healthy to the eye can be observed in the photos to have a problem since they will not have a bright red color. This can be seen as much as a week before death of the plant. Diseased plants have a higher leaf temperature and will be a brighter red in the photos. This photography technique can be a valuable tool for producers, consultants, seed companies, extension personnel and chemical companies.

Introduction

Early in the growing season, a young cotton crop is vulnerable to many hazards such as sand blasting, hail and seedling diseases. When observing fields it is easy to see that many of the plants are dead or dying. The surviving plants need to be evaluated; they are the crop of the future. The dead plants are history. Many producers want to replant when there is an adequate plant stand. Aerial and satellite infrared photography has been used to evaluate crop conditions for many years; however these are unsatisfactory for making replant decisions because of distances involved. Barry Bean, being an amateur photographer found that certain special effects were observed using infrared photography and a yellow filter. Photographs made only a few feet away from the crop had potential for evaluation of crop condition. The slow development time for infrared film development was a problem since replant decisions need to be made immediately. If a digital camera could be used, the photos could be loaded into a laptop and modified in the field and a decision made immediately.

Materials and Methods

Several cameras were used including Sony Digital Mavica MVC FD73 and the newer model, MVC-CD500. A Nikon D100 and Olympus D-390 were also used. The Sony Mavica cameras can detect infrared light whereas some cameras such as the Nikon D100 and Olympus D-390 have built in filters that eliminate infrared light. This was determined by pointing a hand held television remote control at the camera and observing the red dot on the viewfinder. No filters were used in making the photos except when we were determining if infrared light was needed. Using the Sony software the photos were enlarged and cropped with the hue and saturation modified. Photoshop 7.0 was more versatile and allowed individual colors to be modified in addition to shifting the entire spectrum. Photoshop also allows other techniques to be used such as the curves command.

In early planted cotton three row feet was photographed each week to determine surviving plants. Using Photoshop 7.0 hue, saturation, and lightness were adjusted in the master along with yellow and green to achieve the desired effect. The master settings are -180 hue, zero saturation, and zero lightness. The master setting shifts all of the colors around the color wheel a given number of degrees. A saturated color at 100 percent is the maximum amount of color whereas zero saturation means the color will be expressed in black and white. The hue is the amount the color is shifted to another color in the color wheel. The yellow is –180 hue, zero saturation, and 100 lightness. The green is 25 hue, 100 saturation, and 0 lightness.

Results and Discussion

It was first believed that the camera should not have built in internal filters in order to observe the colors seen in infrared film photos. We found that the internal filters were not important. Using a B+W 092 or Hoya R72 filter we achieved a red photo similar to using infrared film without an orange filter but were unable to manipulate it adequately to predict death of the seedlings.

Photoshop 7.0 was used to modify unfiltered photos and results were found that mimicked the infrared photos using an orange filter. Using image, then adjustment followed by hue and saturation commands, the photos were modified to mimic the infrared photos that used a orange filter. With Photoshop the master command shifts all of the colors on the color wheel in degrees going either clockwise for a positive number or counter clockwise for a negative value on the wheel to a maximum of plus or minus 180. Some software uses one turn around the color wheel to be 100 (one unit is equal to 3.2 degrees). The amount of color is controlled by modifying the saturation. Zero saturation is black and white and 100 percent is maximum color. Each color can also be modified independently. The best results were obtained by changing the master (all colors) to a hue of -180 and saturation to zero, green to a hue of twenty five and saturation to 100 and yellow to a hue of -180 and saturation to zero. The leaves were bright red if healthy and green or blue if unhealthy. This can be easily accomplished in the field using a laptop computer. A degree of interpretation is required. Some plants that looked very healthy showed a blue or green color in the modified photos and died in a few days whereas red leaves in the photos survived. Colors can be modified so unhealthy plants are yellow instead of blue and green. Variation in cameras and photographic conditions may warrant modifications of these settings. Other commands for color modification besides the image adjustments of hue and saturation such as curves, levels, invert, replace color and color balance were evaluated. The hue and saturation command was found to be the easiest to use and gave superior results.

Any digital camera is satisfactory for making the replant decisions. The number of pixels is relatively unimportant. Photoshop is superior to software supplied with the cameras since it has so many options and modify color an infinite number of ways.

Summary

Digital photography can emphasize the live tissue with proper color manipulation of the photos, which will aid in making a replant decision. This requires three or less separate steps and can be done in the field with a laptop computer. Photoshop 7.0 was the only software needed.

This technique can be a useful tool for producers, chemical companies, seed companies, crop consultants and extension personnel.

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Figure 1. Seedling cotton on May 3.

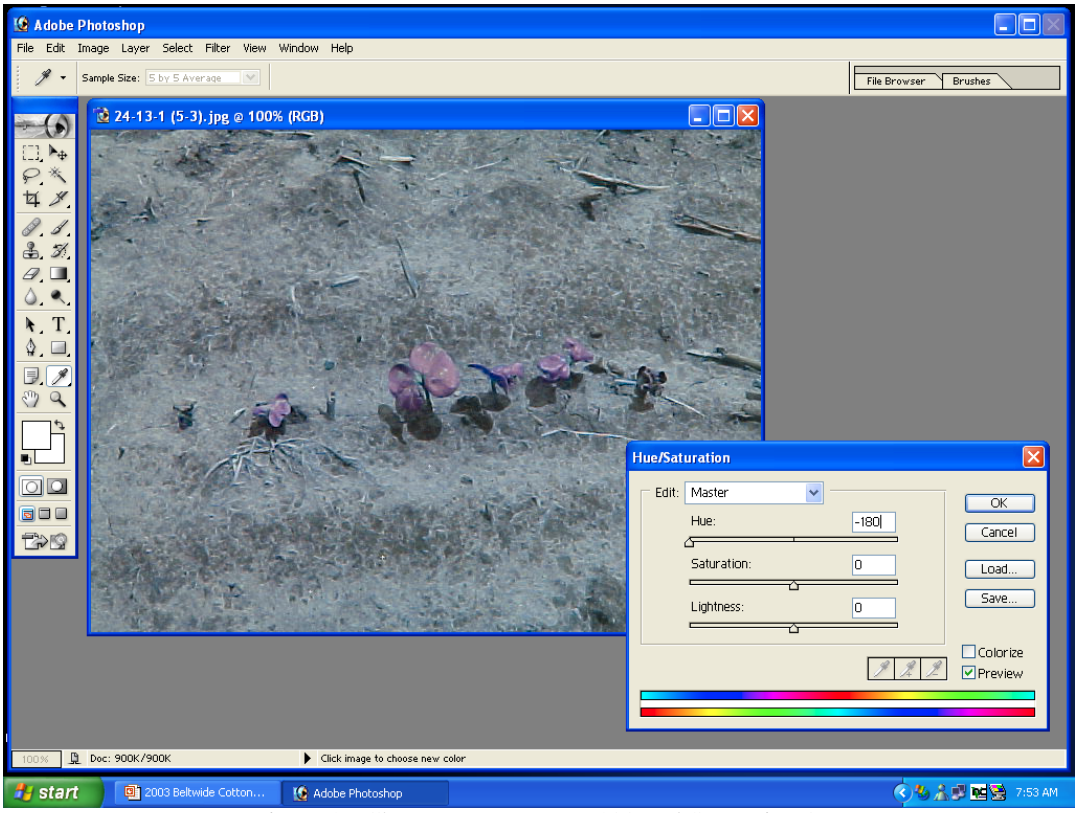

Figure 2. Change Master Hue –180 and Saturation 0.

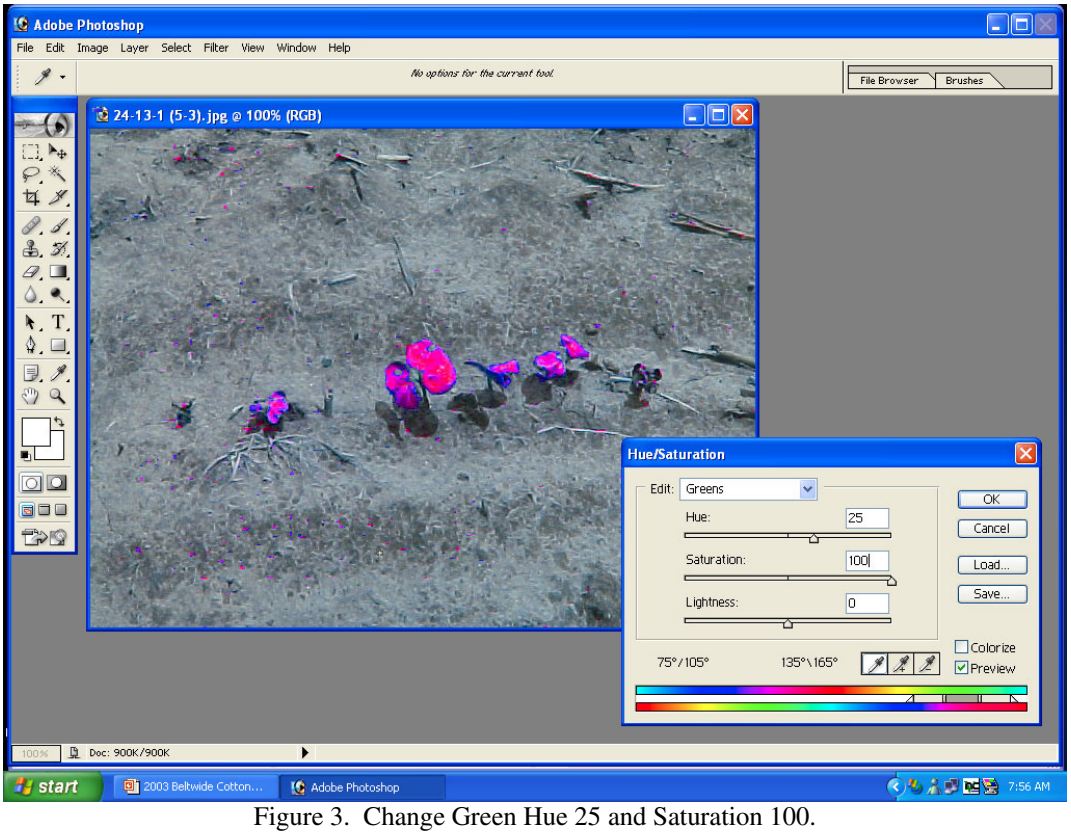

Figure 3. Change Green Hue 25 and Saturation 100.

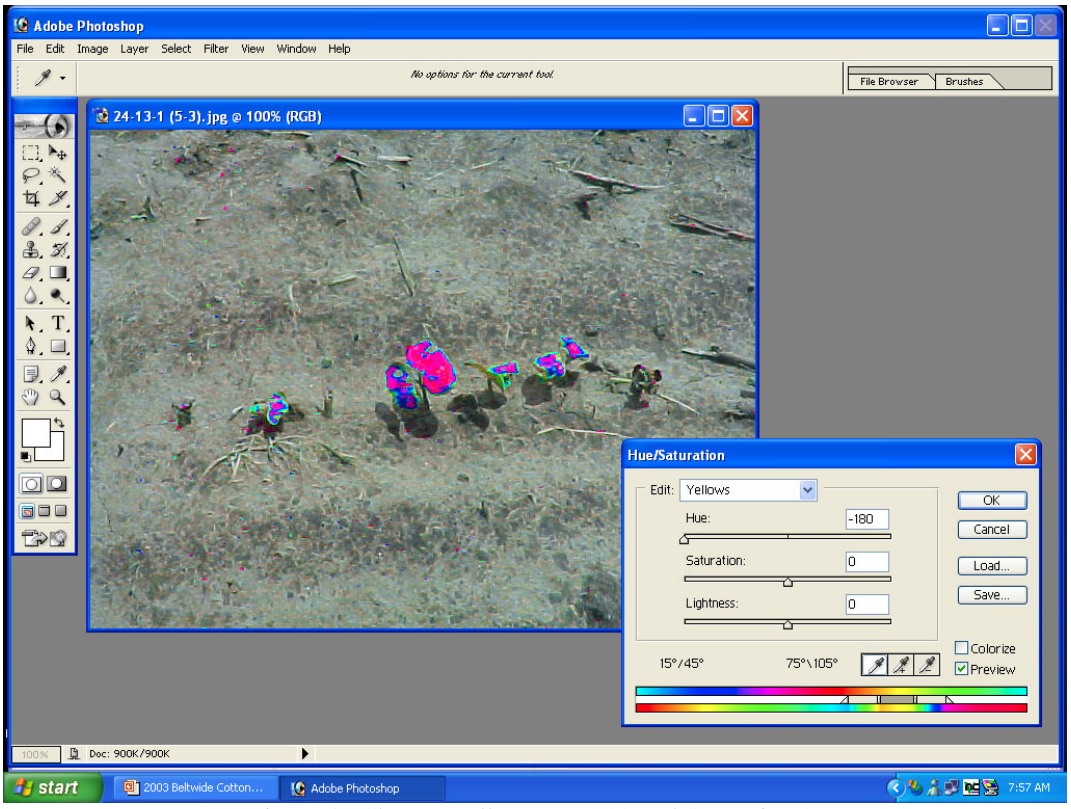

Figure 4. Change Yellow Hue -180 and Saturation 0.

Figure 5. Modified Photograph.

Figure 6. Surviving Plants on May 7.