



On-Farm Research

Why On-Farm Research?

From Boone to Whiteville, farmers and Cooperative Extension agents are teaming up to conduct successful on-farm research. Initiated by a project that began 3 years ago, an on-farm research team of CES agents, non-profit professionals, and NC State University and NC A & T State University faculty has been working to help farmers find their own answers to production questions.

For many years, land grant universities and farmers have become accustomed to Cooperative Extension presenting recommendations based on University research. But given the complexity of agricultural pro-

duction in North Carolina, the new emphasis on specialty crops, and the many new technologies being introduced in agriculture, the Universities are struggling to keep up with requests for information.

To help fill the gap, farmers are taking the lead and adding value to their production experience.

Farmers have always done their own research. Whether it is trying a new variety of crop or a new way to prepare a field without plowing, farmers have always been at the forefront of agricultural innovation. This innovation often went unrecognized because it was not based

on "scientific" research at a research station.

As a team, farmers, agents, extension specialists, and researchers are now developing an applied research model that is statistically sound AND answers farmers' questions. By combining the farmer's experience with the science of statistics, farmers are adding value to the work they do every day. On-farm research places farmers in the driver's seat of the agricultural research agenda.

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What Will I Get From On-Farm Research?

As we go about our work, questions and problems always crop up, no matter what business we're in. Sometimes the answers or solutions are provided to us by friends, co-workers, or from other professionals in the field. But other times answers are not readily available. The question or problem may be peculiar only to our own situation. No one may have the answer.

In all probability, others may have asked the same questions or had the same problem. They, too, may be frustrated by the inability to get answers. Say your neighbor comes along

with a "hot new bean variety" that has, he says, "higher yield"? How does your neighbor know that it will produce a higher yield than the standard variety? Did the seed company representative say so? Was his claim based on "scientific research"? Or did your neighbor grow that variety to see for himself? Can you expect to see higher yields on your farm, too?

Here's another example. Every year you apply an herbicide before planting beans to control weeds. You usually follow this application with a second herbicide application after weeds

come up later in the season. Herbicides are expensive and you've often thought, "What if I skip the pre-plant herbicide to save money?" How will you determine if this is an effective strategy that will save you money, but still give you the yield you expect?

These examples point out situations where growers may want to do their own on-farm research. They seek answers to their own questions, or, when there are questions common to a community, they may work cooperatively with other farmers. When farmers do research on

their own farms, they are, in effect, taking responsibility for solving their own problems.

In actuality farmers are always engaged in research projects on their farms. They try something new, observe the effects of that new thing, and draw conclusions from what they observe. On-farm research can be as simple as an observation study. With a little more work, growers can increase the certainty that the conclusions they draw from their observations are true.

Northampton Compares Cotton Tillage Practices

Discussion yields research results

In 2001, Northampton County Agent Craig Ellison was intrigued by a conversation between three farmers after a production meeting. All three were new to conservation tillage cotton production, and they were lamenting the fact that they never seemed to have the time to get together and discuss what they were learning. That conversation resulted in the development of a conservation tillage discussion group for Northampton County. At regular meetings Northampton County farmers

meet to discuss their experiences with handling different production challenges, from weeds, insects and deer to ruts in the field, to the benefits of conservation tillage.

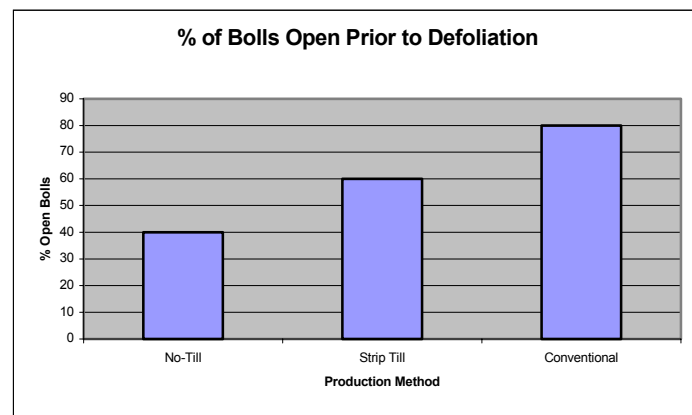
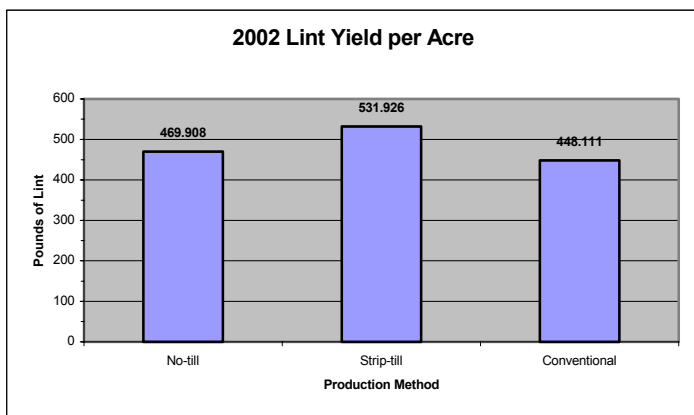
Ellison worked with the group to develop an experiment to compare the yields of no-till, strip-till, and conventional tillage cotton. Ellison and farmers Kelly Van and Joe Martin put out a test that compared the lint yield per acre and the percent bolls opened before defoliation

among the three tillage systems.

In the test, which took place during the drought of 2002, strip-till cotton consistently out-yielded the no-till and the conventional cotton, and the no-till cotton out-yielded the conventional cotton. The conventional cotton had opened the most bolls at the time of defoliation, followed by strip-till, and no-till.

Ellison sees benefits from the discussion group in addressing local problems, and having a

forum for farmers to share their experience. They are currently considering starting a small grains discussion group. Ellison and fellow agent Heather Lifsey are collaborating with a group of growers to screen tomato and pepper varieties for resistance to tomato spotted wilt virus.



Chatham County: Wasps vs. Bean Beetles

Biological control effective, but expensive



Farmer Cathy Jones and Extension Agent Debbie Roos combined forces to measure the cost-benefit of using parasitic wasps for bean beetle control.

When farmer Cathy Jones was looking for an organic method for controlling Mexican bean Beetle in her bean plants, she looked at the release of parasitic wasps, but wasn't sure that the results would justify the high costs. To answer the question, she turned to Chatham County Cooperative Extension Agent Debbie Roos. Together the two of them developed an experiment to test the efficacy of the release of parasitoid *Pediobius foveolatus* that was conducted in 2002.

To test the effects of the wasp release, they set up a paired comparison experiment at Jones' farm. Roos received a grant from the NCSU Integrated Pest Management Program that helped pay for materials and the labor, and replicated the experiment at the Central Carolina Community College land lab. NCSU Extension Specialist David Orr assisted in designing and carrying out the experiment.

One of the main challenges that

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Steps to a Successful Research Project

1. Put your research idea into a question. The question usually turns out to be a comparison of two things, and takes the form of, “Is this better than that?” The “this” and “that” are called the “treatments.”
2. Decide what information you need to collect to answer the question. In most cases the most important information will be the yield of each treatment, but it might be the amount of disease in a field or how fast a cover crop covers the ground.
3. Describe as best you can what each treatment will be. Remember that all farming activities will be the same for both treatments. Any differences you observe (such as increased yield), then, will be because of the difference in the treatment and not because of difference in the way that each treatment is managed.
4. Decide how many times you are going to make the comparison, (number of replications). The more pairs that you have to compare, the more confidence you can have in the results. Make a map of how the replications will be laid out in the field. Decide on the plot size of each treatment.
5. On the map, place the treatments side by side in each replication. Flip a coin to decide which treatment is on the left side in each pair. If the coin toss is heads, put treatment 1 on the left, and if it's tails, put treatment 2 on the left side. Include any border areas that separate blocks or treatments from one another.
6. With a tape measure lay out the plots in the field. Mark the corners of each treatment carefully, so you can find each plot later in the season when the crop (and weeds!) may hide the original perimeter.
7. Outline your management practices (planting rates, fertilizer, pesticide applications, tillage) for the crop and the dates you expect to complete each practice. Before you begin field work for the season, plan how you will get work, such as the planting and harvesting of the treatment plots, done during busy periods. Will you need to have extra wagons on hand? Will you plant the test first, or wait until the rest of your crop is planted and come back and plant the test? Who is responsible for each of the research tasks?
8. Plant the crop, remembering to place each treatment where it is located on the map.
9. Don't trust your memory! Keep accurate records of everything you do to the crop and when you do it. Record rainfall information and any unusual weather (storms, wind, hail, etc.) experienced. If you alter the plan, write down what you did and why you did it. Sometimes facts that don't seem important at the time become very important in understanding why something did or didn't go the way you expected it to.
10. Gather your data. If you are gathering harvest information, plan for enough time to keep harvested product from each treatment in each pair separate.
11. Evaluate the experiment. You can get help with running statistics on the numbers you generate. Did you get an answer to your research question? Did anything happen during the season to change the question?

Planning and Documentation are critical tasks in the design and implementation of On-Farm Research.

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the researchers faced was keeping the wasps out of the control treatment. They created “secure” mini-tunnels to prevent wasps from entering control plots using row covers over masonry wire cages.

Due to problems with disease and poor stand, they shifted the location of the test in the field, and reduced the number of replications. With small plot sizes, they were able to put out 40 plots at Jones' farm, but had to reduce the size of the test at the

CCCC to 10 plots.

The release of the wasps reduced the population of bean beetle larvae from a high of 11 per 5' of row in the control plots to 0.45 per 5' of row in the release plots. Defoliation was reduced from 35% in the control plots to 23%.

Monitoring of the release plots after a second planting of beans and the second generation of beetles showed a reduction in the amount of defoliation to 15%.

While these preliminary results

look good, Jones believes that the price of the control would have to come down significantly for it to be economically feasible. Much of the cost is associated with overnight shipping, which is required to keep the wasp larvae viable. Jones believes that if multiple growers cooperated on a shipment of the parasitoid wasps, it might reduce the cost enough to make economic sense.

North Carolina On-Farm Research

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Avery County Tests Weed Suppression Methods for Firs

New strategy reduces costs by \$20 per acre

In the 1990's, Cooperative Extension recommendations for weed control in Christmas trees shifted from a "bare ground" to a "weed suppression" strategy. Weed suppression maintains a cover on the soil by suppressing weeds rather than killing them outright while significantly reducing soil erosion. The difficulty with this strategy has been the cost of the selective herbicide products used.

To develop a lower-cost option, growers began experimenting with using a reduced rate of Round-Up herbicide to suppress weeds. Initially there was concern about exposure of the trees to damaging rates of Round-up, and the long-term effects of exposure over the life of the tree. In addition to a reduction in costs, a reduced rate of Round-up also selects for a series of low-growing ground covers like strawberry, dwarf white clover, violets and low growing perennial grasses such as nimblewill that reduce weed compe-

tion, further reducing the need for herbicides.

In the Fall of 2000, farmer Bill McNeely asked Avery County Extension Agent Doug Hundley to help determine the efficacy of this strategy and the levels of weed suppression and tree damage that could be expected with different rates of herbicide applied at different times of year. McNeely also recruited 4 other growers to participate in the study. At the time Hundley was involved in a class on On-farm research, and this question became his research project.

In addition to the faculty conducting the class, (NC State, NC A&TSU, and the Rural Advancement Foundation International), Hundley turned to Dr. Joe Neal, Extension Specialist for Christmas trees for help. Together the team developed goals for the project. First year goals were to look at four Round-up application rates, three different timings with two different applicators and meas-

ure the impact of the treatments on tree foliage and weed suppression. The project became quite large, ending up with 19 test plots of 140 trees each (2,260 trees), on five different farms. There were three treatment plans with 6 replications and 7 treatments. This complex experiment proved expensive both in terms of cost and in terms of the time required from both the growers and Hundley.

For 2002, the team added 5 additional growers, and the number of trees in the study jumped to 500,000. In addition, results from 2001 simplified the research plan, excluding treatments that were non-viable because of either too much tree damage or too little weed suppression.

The project addressed and began to answer several questions. Growers found that they could reduce Round-up rates well below those commonly used and achieve effective weed suppression and minimal impact to desirable groundcover species. Growers recorded varying levels of damage to the Fraser fir foliage, much of which was considered either undetectable or acceptable. They concluded that using reduced rates of Round-up to suppress weeds had the potential to reduce herbicide and labor costs, providing a more affordable and sustainable groundcover management system.

For 2003, the research team has expanded the study to include four additional counties, with 19 farmer researchers. They are focusing this year's research on a critical four-week period centered in early June. This period begins about 30 days after bud break and is the most vulnerable stage of Fraser fir foliage to her-

bicide damage.

Growers will be fine-tuning rates, dates, and nozzle configurations to find the safest and most effective way to suppress weeds, without damaging tree foliage, during this early June treatment window.

Hundley believes that they are one study season away from having a complete recommendation for using Round-up any month during the summer with no tree damage, while achieving good weed suppression. The estimate of the total cost of this treatment, including labor, is \$12 per acre. The previously-recommended herbicide cost \$30-40 per acre for materials alone.

In describing this work, Hundley is quick to emphasize that all aspects of the research were planned by the participating growers, including the test treatments, the acceptable or non-acceptable levels of tree damage, and weed suppression ratings. A small group of the growers has also begun working with Jerry Moody, Hundley's fellow extension agent in Avery County, investigating ways to control the disease phytophthora on Fraser Firs.



Cooperative Extension Agent Doug Hundley and Graham Ferrell, production manager for Christmas Greens, discuss plans for their research on weed suppression practices.

Henderson County: Production and Economics of Organic vs. Conventional Apples

Double the costs, but triple the net return

In 2000, Henderson County apple farmer Richard Staton received word that Gerber Products Company, one of the principal buyers of his processing apples, was looking for reduced-pesticide apples for baby food.

He approached Cooperative Extension agent Marvin Owings about evaluating organic apple production systems to see if they had a future. Since that time, a small group of apple growers in Henderson County has been

researching organic apple production and comparing the net return of organic versus conventional production.

According to Owings, "We're pleased that tests in both years had at least one orchard that produced very good quality fruit. We've shown that with

a lot of hard work organic apples can be grown in the Southeast."

The benefits of growing organic apples have also become obvious. In 2002, the production cost per bushel for organic produced apples was twice that of conventional apples (\$4.03/Bu for conventional and \$8.21 for organic). However because of higher value, the net return per bushel for transitional organic apples was \$17.99 as compared with \$4.97 for conventional apples of the same variety. Yields were similar for organic and conventional orchards. The organic price will increase when several of the growers have their orchards certified this year. At

one time during the 2002 season the retail price for South American, Golden Delicious Certified Organic apples was as high as \$60 per bushel.

As part of the research, participating growers measured yields, size, and percentage of packable apples. They also accessed the damage on culled fruit. Armed with this information, growers were able to work in the off-season to shore up and make

specific changes in pest control strategies and cultural practices. "It is much more technical than the normal demonstrations that we are used to doing," says Owings, "but the extra time and effort is paying off. It has really helped us to improve our cultural practices which in turn helps us to produce better quality for the next season."

By working together as a group with NCSU Cooperative Extension, growers have been able to identify resources that would not have been available otherwise.

Over 27 different companies have donated products for the research.

The participating growers have learned a series of important lessons from the research. Early-maturing apples have done better in both years, possibly because the earlier harvest means less exposure to pests. The location of the orchard is also important. Fruit grown at higher elevations performed better due to lower humidity, improved air drainage and reduced pest pressure. It has also been very im-



Henderson County Cooperative Extension agent Marvin Owings showing disease damage on organic apple trees.

portant for growers to stay ahead of pest problems.

According to Owings, "Organic production is unforgiving. You really have to stay on top of cultural practices."

Growers have also learned about marketing. Although surveys say that consumers are willing to buy lower grade apples if they are organic, the growers have found that the market expects fruit to have the same quality as conventional. However along with quality, the growers have seen that people prefer local produce. Both locally grown and organic apples provide growers with a new niche market with higher demand.

In addition to comparisons of organic and conventional, the growers are using on-farm research to test the efficacy of products that are allowed under strict organic certification standards. This year they will test high acid vinegar as an herbicide.

These tests are important to improving the organic system and further reducing costs.

One of their biggest hurdles has been with people who do not believe that organic apples can be grown in North Carolina or the Southeast. When a Southeast produce buyer came up from Florida to look at producer Anthony Owens' apples, he was impressed because the fruit around him looked so good. "Where is the organic orchard?" he asked. To the buyer's amazement, Owens replied "You're standing in it."

If you want to see organic apple production for yourself, come to the Organic Apple Tour which will take place August 21st near Hendersonville. Orchards involved in this research project will be a part of the tour. For more information contact Marvin Owings at the NC Cooperative Extension Henderson Co. Center, (828)697-4891 Marvin_Owings@ncsu.edu.

North Carolina On-Farm Research

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Reducing Peanut Production Costs in Martin County

Martin County peanut and cotton farmer David Mayer has seen the benefits of on-farm research where it counts, in his checkbook. Mayer has been a part of a group of farmers testing the need for an insecticide for rootworms in peanuts.

Mayer reports, "We did a side by side comparison of with and without insecticide for two years and didn't see any difference in yield or damage. It (insecticide) might help in a wet year, but it will hurt you in a dry year, and there is more of a chance that we are going to be dry than wet in July and August."

Mayer combines his experience

with on-farm research with information in the NCSU Rootworm Index, which uses crop characteristics to give farmers an idea of the risk of rootworm infestation in a particular field. Mayer says he saves \$20 per acre by not applying an insecticide for rootworm control. "In a dry year, this also means I save \$20 per acre on a miticide application. That's a huge part of my overall spray bill. I'm not saying I never need to treat, but I like being able to make an informed decision."



David Mayer (left foreground in white hat) and other farmers discuss peanut pest management on a tour of Mayer's farm.

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