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Planting Fall Brassicas, Broccoli and Pak Choi into German Foxtail Millet No-Till Verses Strip-Till Without Herbicides

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Introduction

This research project investigates low input vegetable production techniques for the fall Brassicas, Broccoli *Brassica oleracea L. Italica group,* and Pak Choi Chinese cabbage *Brassica rapa L Chinensis group* no-till verses strip-till planted into German foxtail millet *Setaria italica*. In the Mid-Atlantic region summers are typically hot and droughty, while spring and fall conditions are generally moderate in both temperature and rainfall. The development of fall cropping and marketing options helps to spread production risks, and take advantage of a period of generally moderate weather conditions. The utilization of a summer annual cover crop in between an early spring and late fall crop greatly expands the farm production window, adds crop diversity, and distributes the crop production workload over a longer time period. In the future it may even be possible to receive carbon credit payments for producing summer cover crops solely for the sequestering of CO_2, a known greenhouse gas. German foxtail millet is heading 60 days after planting, and if properly timed will be senescing in the fall coinciding with the rapid growth of a fall-transplanted brassica. Therefore, this research was designed to utilize the natural maturation of the millet to suppress fall weed growth when planting broccoli and pak choi, avoiding costly conventional tillage, and herbicide applications.

Methods

The project was designed as a randomized complete block, with 4 replications and 4 treatments. The 4 treatments consisted of the comparison of no-till verses strip-till of the two vegetables broccoli, *var. Sultan,* and pak choi, *var. Joi Choi*, into German foxtail millet. The treatment plot dimension was 10 ft X 15 ft with the transplants spaced 24 inches in the row by 5 feet between rows. There were 14 plants per plot with a density of 4,356 plants per acre. The

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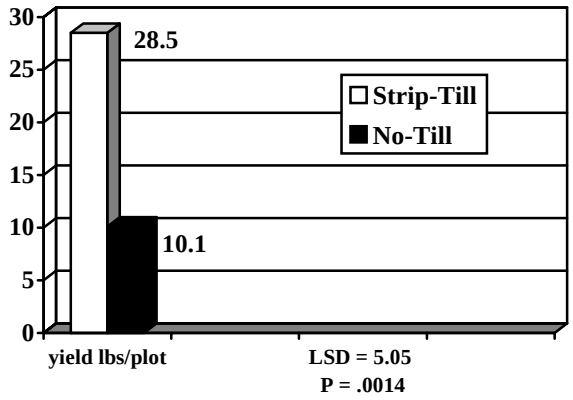
research trial was conducted in 2000 at the University of Maryland Research and Education Center in Upper Marlboro, Maryland, on a Monmouth fine sandy loam soil. No-till Corn *Zea mays L*. was the preceding crop, and the field was conventionally prepared prior to planting the German foxtail millet on June 3, 2000. The millet was seeded at a rate of 25 lb/acre utilizing a Brillion® culti-packer seeder. Four weeks after planting, 30 lbs/acre of nitrogen was broadcast applied to the millet. Soil tests revealed optimum levels of phosphorus and potassium for the site.

On August 3, 2000 the plots were prepared and planted with 5-week-old broccoli and pak choi transplants raised in the campus greenhouse in 128 cell Speedling® trays. The no-till plots were directly transplanted into the millet canopy utilizing the Morse SST 1000 no-till vegetable transplanter. The strip-till plots were prepared by mowing a 22-inch swath directly over the row middle with a heavy-duty large wheeled push type mulching mower. Immediately following the mowing a 5-foot three-point hitch roto-tiller, with all but on set of tines removed, was operated down the row middle to thoroughly work an 18-inch wide strip to the plow layer depth. The mowing and mulching of the millet was necessary to avoid wrapping of the tall millet crop on the roto-tiller tine bar. After the strip-till simulation the broccoli and pak choi transplants were planted using the SST 1000 no-till transplanter. Transplant water was sufficient to initiate growth and no further irrigation was required during the production time period. After planting, 400-lbs/ acre of 20-10-20 fertilizer was hand applied over the row. Two applications of Warrier® 3 oz/acre and one application of Dipel® 0.5 lb/acre were applied on a 10-14 day schedule for insect control.

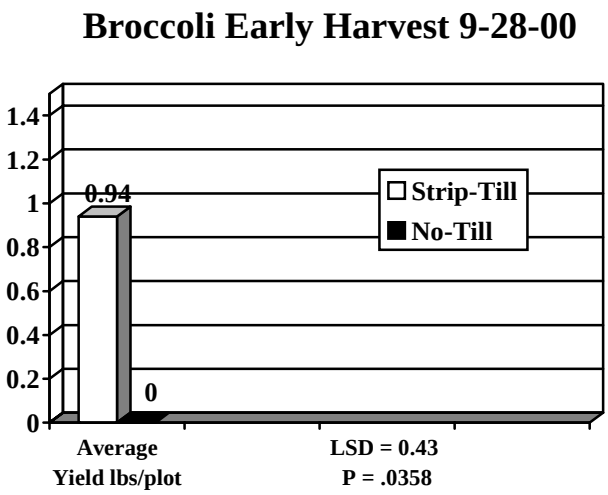
Results and Discussion

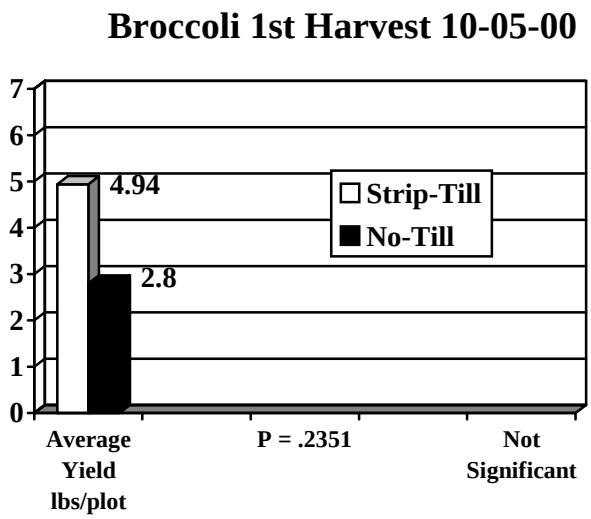
Pak Choi Plot Yield 9-7-00

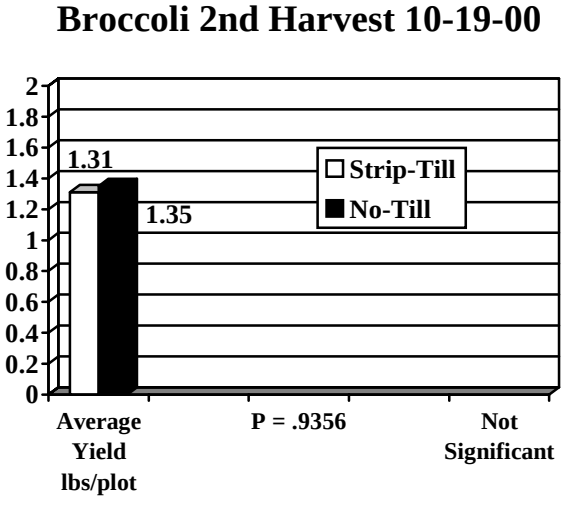


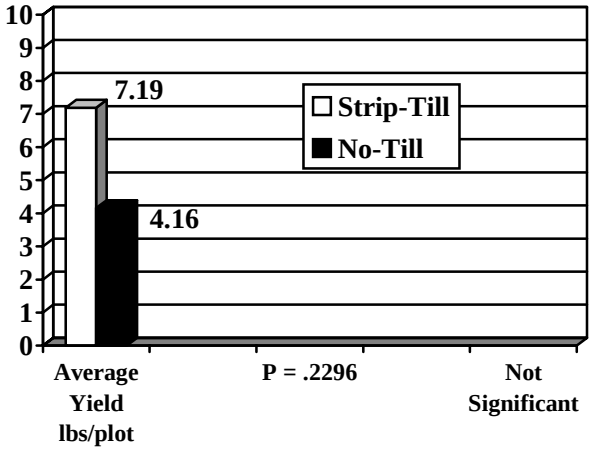
All of the pak choi plots *var. Joi Choi* were harvested on September 7, 2000, 35 days post-transplanting. There was a significant average yield difference between the strip-till and no-till plots of 28.5 lbs/plot and 10.1 lbs/plot, respectively. The pak choi heads were marketable quality from both the strip-till and no-till plots, however, the strip-till plots averaged 2.04 lbs/head, whereas, the no-till plots averaged only 0.72 lbs/head. The strip-till plots produced a 65% higher yield advantage over the no-till plots. It was observed that the pak choi in both the strip-till and no-till plots were at the same growth stage at harvest, and merely allowing the no-

till plots to continue to size would have most likely produced a tougher, less marketable crop. In both the strip-till and no-till plots the pak choi transplants grew so rapidly that no new weeds developed, and the anticipated hand hoeing of new weed growth was not required. The apparent reduced growth in the no-till plots would have to be attributed to competition directly with the millet cover for water, nutrients and sunlight. The millet cover was extremely aggressive and produced a nearly pure stand with only some co-emerging goosegrass and crabgrass weeds present. It was observed that for the strip-till plots herbicides were not required, however, for the no-till plots following planting with an over the row application of 1.5 pts/acre Poast® *sethoxydim,* a graminicide, to the millet may have offset the yield losses.









The strip-till plots had marketable broccoli florets, which were harvested early on September 28, 2000, 56 days post transplanting. All plots were fully harvested on October 5, 2000, 61 days post transplanting, and the strip-till plots averaged 4.94 lbs/plot, whereas, the no-

till plots averaged 2.8 lbs/plot. The observed yield difference was as dramatic and similar to the pak choi yield results, however, for one of the four replications, the no-till plot out yielded the strip-till plot, and this data reversal confounded the statistical analysis. A second plot harvest on October 19, 2000 resulted in almost equivalent average broccoli yields for both the strip-till and the no-till plots of 1.31 and 1.35 lbs/plot, respectively. An examination of the total broccoli harvest reveals a large, although not significant, yield difference between the strip-till and no-till plots, again due to the early outlying replication. Similar to the pak choi average total yield results, the strip-till broccoli yields were nearly double the no-till yields, at 7.19 lbs/plot and 4.16 lbs/plot respectively. The strip-till broccoli average plot yields were 42% higher than for the no-till plots. For broccoli the significant strip-till advantage was during the early growth period only, this may be attributed to the slower growth of the broccoli and a fuller senescence of the millet at the time of first harvest. The broccoli actually continued to produce florets into November although greatly reduced in size and marketability. Weed control for newly emerged weeds was not required just as in the pak choi plots, and most competition early should be attributed to the millet cover crop.

Conclusions

In 2001 the experiment will be repeated which should greatly enhance confidence in yield and the production techniques for fall strip-tilling and no-tilling brassicas into German foxtail millet. A summary of average yields for pak choi and broccoli strip-tilled and no-tilled into millet translated into a per acre basis reveals the following comparisons: Based upon actual harvest from the plots of marketable crop, the pak choi average total yields for the strip-till and the no-till plots were 8,276 lbs/acre and 2,933 lbs/acre, respectively. The broccoli average total yields for the strip-till and no-till plots were 2,088 lbs/acre and 1,208 lbs/acre, respectively. The strip-till pak choi yield was excellent and it appears that herbicides and excessive tillage are unwarranted. The broccoli yield was not as high as desired for either the strip-till or the no-till plots, and the crop did display evidence of nitrogen deficiency in the lower leaves. Additional side-dressed nitrogen will be applied next year, possibly through trickle-fertigation if irrigation is required. It can be concluded that fall strip-tilling into a millet cover offers a viable alternative production technique for fall brassicas.