# A COMPARATIVE STUDY ON THE EFFECTIVENESS OF NATURE FARMING AND CONVENTIONAL FARMING TECHNOLOGIES ON THE GROWTH AND YIELD OF DAPIT-SAKA RICE SELECTION

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## ABSTRACT

The agronomic characteristics and yield of Dapit Saka rice selection grown using the conventional farming and nature farming methods were compared and the effect of the different nature farming concoctions against rice pests and natural enemies were evaluated from November 2002 to February 2003 in Bongco, Pototan, Iloilo. Results revealed that rice whorl maggots (*Hydrellia philippina*), white leafhoppers (*Cofana spectra*), green leafhoppers (*Nephotettix virescens*), brown planthopper (*Nilaparvata lugens*), rice stemborers (*Scirpophaga innotata*) and grasshoppers (*Oxya hyla intricata*) were found feeding on rice. Natural enemies observed included a mirid bug (*Cyrtorhinus lividipennis)*, lady beetle (*Micraspis crocea),* damselfly (*Agriocnemis* spp.), ground beetle (*Ophionea nigrofasciata*), vespid wasp and spiders (Lynx spiders, *Oxyopes* spp.; dwarf spider, *Atypena formosana*; Orb spider, *Argiope catenulata*; and long-jawed spider, *Tetragnatha maxillosa*). It was noted that the use of nature farming technology and the absence of pesticides in the control resulted in more natural enemies. However, plants grown in conventional farming were significantly taller, had the most number of tillers, and heaviest panicles. These resulted in the highest grain yield of 3,466 kg/ha, a net income of P19,643.00 and an ROI of 130.80 % . These values exceeded those of plants in the nature farming technology by 1,641 kg/ha, P 5,612.65 and 25.80 %, respectively.

## INTRODUCTION

Rice farmers in the Philippines generally practice the conventional method of rice farming. This method utilizes inorganic inputs like fertilizers and pesticides to increase production. Inorganic fertilizers provide plants with sufficient amounts of readily available nutrients, whereas, commercial pesticides assure effective rapid action against insect pests. However, continued dependence on these inputs had created problems like pest resurgence, health hazards from pesticides, and soil acidity and water pollution from fertilizers.

The harmful effects brought about by the use of inorganic inputs (*Far Eastern Agriculture*, March/April 2001) prompted the agriculture sector to look for alternative methods that will support the growth of crops as well as protect them without endangering the health of the farmers and without altering the balance of the ecosystem. These methods include the use of botanical pesticides (Von Der Heyde, Saxena & Schmutterer, 1983 as cited by Schmutterer, 1984; IIRR, 1987; Singh, 1996; Agriculture Magazine, December 1998 & April 2001), biological control agents (Shepard, Barrion & Litsinger, 1987) and organic fertilizers (Agriculture Magazine, August 2000; Pandey, 1991; Farming Updates, 1991; Sangatanan and Sangatanan, 1993). One of the alternative methods developed whereby we live in harmony with nature is the nature farming technology (Lim, 2002). Nature farming is a farming method developed in Korea. It utilizes beneficial microorganism and an array of indigenous plant materials which oftentimes are just left as farm residue. The Davao experience showed that old unproductive calamansi, pomelo and cacao trees were rejuvenated after three months of using the different concoctions (Lim, 2002). There had also been claims that the use of nature farming improved the growth and yield of vegetables and rice, but there are no concrete data to support these claims. It is for this reason that this study was conducted. Results from this study can show whether or not the technology can be adopted in Iloilo and whether or not it is also applicable to rice.

*Objectives of the study.* The objectives of this study were to:

1. Compare the agronomic characteristics and yield of Dapit Saka rice selection grown using conventional farming and nature farming methods, and
2. Evaluate the effect of the different nature farming concoctions against rice pests and natural enemies.

*Time and place of the study.* The study was conducted in November 2002 to February 2003 at the Jamandre farm in Bongco, Pototan, Iloilo.

## MATERIALS AND METHODS

A total area of 393.68 square meters was prepared. The treatments which were composed of the conventional method of farming (using chemical inputs), nature farming (using concoctions) and the check or control (no pesticides and fertilizers) were laid out in a randomized complete block design with four replications. Nature farming concoctions such as Fermented Fruit Juice (FPJ), Fish Amino Acid (FAA) and Indigenous Microorganisms (IMO) were incorporated together with decomposing rice straws which served as organic fertilizer during plowing.

Three kilograms of seeds were soaked in tap water containing FPJ, OHN (Oriental Herbal Nutrient) and coconut vinegar before sowing.

The 22 day-old seedlings were pulled and transferred in a dry place. A day after, the seedlings in the nature farming treatment were soaked for 15 seconds in OHN, FPJ, and vinegar concoctions for seedling treatment and immediately brought to the experimental plots for planting. Three seedlings were planted per hill with the aid of a planting board with 20 cm x 20 cm markings to ensure uniform plant spacing.

Plants grown under the conventional farming were fertilized with ammonium phosphate(16-20-0), muriate of potash(60% $K_2O$) and urea (46%N) following a recommended rate of 120-30-30 kg of N, $P_2O_5$, and $K_2O$/ha. Insect pests and their natural enemies were monitored weekly. Pests that attacked plants grown under the conventional farming were controlled using Vexter 300 EC (Chlorpyrifos). Brown leaf spot was also observed and rated as part of data collected.

Plants grown using the nature farming technology were sprayed weekly with concoctions such as OHN, FAA, FPJ, and IMO from one week after transplanting (WAT) to seven WAT. During the change over stage, that is, when the plants were eight WAT, the plants were sprayed with concoctions such as FAA, FPJ, OHN and calcium phosphate at weekly interval until harvest.

Weed control for both farming technologies was done only once by hand pulling two WAT prior to fertilizer application. Shallow water depth was maintained three days after transplanting until hard dough stage. The field was drained for sometime to destroy the eggs of brown planthoppers (BPH) laid in the leaf sheaths (Agriculture Magazine, November 2000) and finally drained two weeks before harvesting to hasten the maturity of grains.

All data except the one on yield were gathered from ten randomly selected hills from the 14 inner rows per plot. Brown leaf spot disease was rated using the following scalar rating: 1 for resistant, 2 for intermediate and 3 for susceptible (Rice Technical Working Group, n.d.).

All data except those on actual count of insects and natural enemies were statistically analyzed using the analysis of variance for a randomized complete block design. Significant treatment mean differences were determined using the Duncan's multiple range test. Both analysis were set at the 1 % level of significance.

## MAJOR FINDINGS

*Periodic Count of Insect Pests and Natural Enemies.*

A number of rice insect pests such as rice whorl maggot (RWM) *Hydrellia philippina*, white leafhoppers (WLH) *Cofana spectra*, green leafhoppers (GLH) *Nephotettix virescens*, rice stem borers (RSB) *Scirpophaga innotata* and grasshoppers (GH) *Oxyahyla intricata* were recorded three WAT. Along with the occurrence of these pests, the natural enemies such as the mirid bugs (*Cytorhinus lividipennis*), damselflies (*Agriocnemis* spp.), lady beetles (*Micraspis crocea*), and spiders namely lynx spiders (*Oxyopes* spp.), dwarf spider (*Atypena formosana*), Orb spider (*Argiope catenulata*), and long-jawed spider (*Tetragnatha maxillosa*) were also recorded.

The brown planthoppers appeared four WAT in addition to the other pests already mentioned with white planthoppers which although a minor pest, had the most number until the sixth WAT. Plants grown with nature farming technology and the untreated plants had the most number of natural enemies with the addition of ground beetle (*Ophionea nigrofaciata* and vespid wasps. The increase in number of natural enemies was observed following the build up of the pest population. This is the usual response of the natural enemies, that is, they will only reproduce when pest population had increased which is favorable for their future offspring to survive. Of the natural enemies, spiders on the conventional farming technology plots were the most affected by the pesticide sprayed.

Table 1. Periodic Count of Insect Pests and Natural Enemies

Three WAT

| | Insect Count | | | | | | Natural Enemies | |
|---|---|---|---|---|---|---|---|---|
| Treatments | RWM | WPH | GLH | BPH | SB | GH | Insects | Spiders |
| Nature farm | 2.50 | 1.50 | 0.25 | 0.00 | 0.25 | 0.25 | 0.00 | 3.50 |
| Conventional | 5.25 | 5.00 | 0.25 | 0.00 | 0.25 | 0.75 | 0.25 | 1.75 |
| Control | 6.25 | 5.25 | 0.00 | 0.00 | 0.50 | 0.75 | 0.75 | 3.50 |

Four WAT

| | Insect Count | | | | | Natural Enemies | |
|---|---|---|---|---|---|---|---|
| Treatments | WPH | GLH | BPH | SB | GH | Insects | Spiders |
| Nature farm | 4.25 | 0.00 | 0.00 | 0.50 | 0.50 | 0.00 | 4.00 |
| Conventional | 2.00 | 0.25 | 0.00 | 0.00 | 1.00 | 0.00 | 0.50 |
| Control | 2.50 | 0.25 | 1.25 | 0.00 | 0.50 | 1.25 | 5.50 |

Five WAT

| | Insect Count | | | | | Natural Enemies | |
|---|---|---|---|---|---|---|---|
| Treatments | WPH | GLH | BPH | SB | GH | Insects | Spiders |
| Nature farm | 4.75 | 0.00 | 0.50 | 0.75 | 0.50 | 0.50 | 1.75 |
| Conventional | 6.75 | 0.00 | 0.50 | 0.75 | 1.00 | 0.25 | 0.25 |
| Control | 7.00 | 0.00 | 1.50 | 1.25 | 1.00 | 0.25 | 2.50 |

Six WAT

| | Insect Count | | | | | Natural Enemies | |
|---|---|---|---|---|---|---|---|
| Treatments | WPH | GLH | BPH | SB | GH | Insects | Spiders |
| Nature farm | 4.00 | 0.00 | 1.25 | 0.25 | 0.50 | 1.25 | 2.75 |
| Conventional | 15.00 | 0.50 | 0.75 | 0.25 | 1.75 | 0.25 | 2.50 |
| Control | 2.25 | 0.50 | 0.25 | 0.25 | 0.50 | 2.00 | 1.75 |

Seven WAT

| | Insect Count | | | | | Natural Enemies | |
|---|---|---|---|---|---|---|---|
| Treatments | WPH | GLH | BPH | SB | GH | Insects | Spiders |
| Nature farm | 0.25 | 0.50 | 0.50 | 0.50 | 0.25 | 2.25 | 5.00 |
| Conventional | 4.75 | 1.25 | 0.25 | 0.00 | 0.00 | 1.50 | 1.00 |
| Control | 2.00 | 1.25 | 1.75 | 0.25 | 0.75 | 3.00 | 6.50 |

Eight WAT

| | Insect Count | | | | | Natural Enemies | |
|---|---|---|---|---|---|---|---|
| Treatments | WPH | GLH | BPH | SB | GH | Insects | Spiders |
| Nature farm | 0.00 | 0.75 | 0.25 | 0.25 | 0.50 | 3.00 | 2.75 |
| Conventional | 1.00 | 0.00 | 0.75 | 0.00 | 1.00 | 5.00 | 0.25 |
| Control | 1.50 | 0.75 | 0.25 | 0.00 | 0.50 | 2.75 | 3.00 |

Nine WAT

| | Insect Count | | | | | Natural Enemies | |
|---|---|---|---|---|---|---|---|
| Treatments | WPH | GLH | BPH | SB | GH | Insects | Spiders |
| Nature farm | 0.00 | 0.75 | 0.50 | 0.00 | 0.75 | 4.50 | 2.25 |
| Conventional | 2.50 | 0.25 | 0.50 | 0.00 | 2.25 | 2.25 | 1.50 |
| Control | 0.00 | 0.75 | 0.25 | 0.00 | 0.00 | 5.50 | 3.25 |

Plants applied with nature farming technology and the check or the untreated plants had the most number of natural enemies.

*Plant Height*

Plant height (Table 2) was measured ten WAT after transplanting. This period coincided with the reproductive stage when plants are no longer increasing in height. Results revealed that height of rice ranged from 79.81 to 98.22 cm with plants grown using the conventional method being significantly ($P<0.01$) the highest. Plants grown using the nature farming technology had comparable height as those in the control treatment.

Table 2. Height Measurement Taken Ten Weeks after Transplanting.

| Treatments | Replication | | | | Mean |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| | cm | | | | |
| Nature farm | 76.49 | 80.67 | 86.00 | 80.22 | 80.84[b] |
| Conventional | 96.95 | 96.07 | 101.68 | 98.19 | 98.22[a] |
| Control | 80.67 | 82.49 | 80.08 | 75.98 | 79.81[b] |

[ab] Treatment means followed by the same letter superscript are not significantly different at the 1 percent level of probability.

*Number of Tillers*

Rice in the conventional method treatment produced the most ($P<0.01$) number of tillers at 15.50. Plants in the nature farm and control plots gave a comparable number of tillers (Table 3) at 11 and 11.75, respectively. Of these tillers, 12 turned out productive from plants in the conventional method, whereas, 8.25 and 7.75 turned out productive from the nature farm and control plants, respectively (Table 4). The data show that the number of productive tillers have a similar trend as that of the number of tillers at maximum vegetative growth, that is, the highest (($P<0.01$) was obtained from plants in the conventional plots, with the number of productive tillers from plants in the nature farm and control plots being comparable.

Table 3. Number of Tillers at Maximum Vegetative Growth Taken Five Weeks after Transplanting (WAT).

| Treatments | Replication | | | | Mean |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| Nature farm | 11 | 10 | 11 | 12 | 11.00[b] |
| Conventional | 14 | 16 | 18 | 14 | 15.50[a] |
| Control | 10 | 12 | 12 | 13 | 11.75[b] |

[ab] Treatment means followed by the same letter superscript are not significantly different at the 1 percent level of probability.

Table 4. Number of Productive Tillers Taken Before Harvest.

| Treatments | Replication | | | | Mean |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| Nature farm | 9 | 8 | 7 | 9 | 8.25[b] |
| Conventional | 11 | 13 | 13 | 11 | 12.00[a] |
| Control | 7 | 8 | 8 | 8 | 7.75[b] |

[ab] Treatment means followed by the same letter superscript are not significantly different at the 1 percent level of probability.

## *Disease Rating*

Data in Table 5 show the rating on the damage caused by brown leaf spot *(Cercospora janseana)* on rice. The result showed that plants raised under conventional method of farming were more resistant (Scale 1) to brown leaf spot than those raised under nature farming technology and the control or untreated plants which showed intermediate resistance.

Table 5. Scalar Rating of Brown Leaf Spot Taken Eleven Weeks after Transplanting.

| Treatments | Replication | | | | Mean* |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| Nature farm | 1.50 | 1.80 | 1.90 | 1.80 | 1.75 |
| Conventional | 1.10 | 1.00 | 1.00 | 1.10 | 1.05 |
| Control | 2.20 | 1.50 | 1.90 | 2.00 | 1.90 |

* 1 - resistant
2 - intermediate
3 - susceptible

## *Average Weight per Panicle*

The panicle weight (Table 6) ranged from 16.40 to 30.80 grams. Statistical analysis revealed that the heaviest panicles ($P<0.01$) were harvested from plants in the conventional method plots. Panicles from these plants weighed 29.7 grams on the average. Panicle harvested from plants in the nature farm and control plots had comparable weights of 19.08 and 18.08 grams, respectively.

Table 6. Average Weight per Panicle.

| Treatments | Replication | | | | Mean |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| Nature farm | 17.80 | 16.90 | 20.70 | 20.90 | 19.08[b] |
| Conventional | 30.30 | 29.90 | 30.80 | 27.80 | 29.70[a] |
| Control | 16.40 | 19.20 | 18.90 | 17.80 | 18.08[b] |

[ab] Treatment means followed by the same letter superscript are not significantly different at the 1 percent level of probability.

*Yield*

Plant yield was obtained from a 13.44 square meter effective plot area. Plot yield was corrected to 14% moisture content then converted to kilograms per hectare. Statistical analysis revealed that yield of plants in the conventional method was significantly (P<).01) the highest at 3,466 kilograms per hectare. As with the other data, yields from plants in the nature farm and control plots were comparable. Plants raised using conventional method gave a yield advantage of 1,641 kg/ha over the nature farming method and a yield advantage of 1,625 kg/ha over the control. Rice yield from the nature farm and the control differed only by 16 kg/ha.

Table 7. Corrected Yield.

| Treatments | Replication | | | | Mean |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| | ---------- kg/ha ---------- | | | | |
| Nature farm | 1642 | 1839 | 1848 | 1970 | 1825[b] |
| Conventional | 3475 | 3644 | 2998 | 3746 | 3466[a] |
| Control | 1657 | 1904 | 1995 | 1806 | 1841[b] |

[ab] Treatment means followed by the same letter superscript are not significantly different at the 1 percent level of probability.

*Cost and Return Analysis*

The cost and return analysis (Table 8) show that plants in the conventional farming technology gave the highest net income of P19,643.00 , followed by the control plants with P10,200.00 and the nature farming technology with P4,905.35. The area where the experiment was conducted was not cropped for several seasons, thus yield from the control plants was almost comparable to that in the

nature farm. Since no input was applied to the control plots, the resulting net income was higher in the control.

Among the two technologies, conventional farming resulted in the highest return on investment (ROI) of 130.80 %, which was 94.05 % higher than that of nature farm. The ROI from the control treatment, however, exceeded that of nature farm by nearly 90 %.

Table 8. Cost and Return Analysis.

| Treatments | Yield | Gross Income | Production Cost | Net Income | Return of Investment |
|---|---|---|---|---|---|
| | kg/ha | | p | | % |
| Nature farm | 1,825 | 27,375 | 13,344.65 | 14,030.35 | 105.00 |
| Conventional | 3,466 | 34,660 | 15,017.00 | 19,643.00 | 130.80 |
| Control | 1,841 | 27,615 | 8,210.00 | 19,405.00 | 236.00 |

Prevailing price/kg of palay from conventional farming is P10
Prevailing price/kg of palay from nature farming and the untreated is P15

## CONCLUSIONS AND RECOMMENDATIONS

On the basis of the outcome of the short-term study, plants in the conventional technology outperformed those in the nature farming technology in terms of agronomic characteristics, yield, net income and ROI. However, it is recommended that a long term-term (2 years or more) comparative study be conducted to assess the cumulative effects of the applied organic residues under the nature farming technology.

## REFERENCES

Cultural management practices for pest control in rice. (2000 November). *Agriculture Magazine, 4* (11), 24-25.

FAO warns of harmful pesticides. (2001, March/April). *Far Estern Agriculture.*

Lim, A. (2002, July). *Nature farming.* Lecture given during the Nature Farming Seminar, Jamandre Industries Training Center, Lapaz, Iloilo City.

Madre de cacao as fertilizer for lowland rainfed rice. (1991, October-December). *Farming Updates, 3*(4), 3-4.

Makabuhay. (1998, December). *Agriculture Magazine, 2* (12), 22.

Pandey, R.K. (1991). Crop Residues. *A Primer on Organic Based Rice Farming.* Manila: International Rice Research Institute.

Rice Technical Working Group, NSIC, DA. (N.d.). National cooperative testing manual for rice: Guidelines and policies. Munoz, Nueva Ecija, Philippines: PRRI.

Sangatan, P.D. & Sangatan, T.L. (1993). Ipil-ipil leaves as organic fertilizer. *Organic Farming Journal*, 7 (4), 14.

Schmutterer, H. (1984). Neem research in the federal republic of Germany since the first international neem conference. *Natural Pesticide from the Neem Tree (Azadirachta indica A. Juss) and other tropical plants.* Proceedings of the Second International Neem Conference, May 1983. schborn, Germany: Dt. Ges. fur Techn. Zusammenarbeit (GTZ) GmbH.

Singh, R.P. (1996). *Promising pest control plant species of Asia and the Pacific.* (FAO/UN: RAP Publication Monograph No. 24). Bangkok, Thailand.