Fertilizer Sector Improvement (FSI+)

MAIZE CROP CUT SURVEY REPORT | WET SEASON 2018

Agreement Number BFS-IO-15-00001

January 2019
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Photo 1. Farmers Participate in Removing Husks from Maize Crop Cuts in Taw Yar Village, Lawksawk Township
Photo 2. Field Day Participation in a Farmer’s Maize Demonstration Plot in Eine Pu Village, Pindaya Township
## Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>BU</td>
<td>Briquette Urea</td>
</tr>
<tr>
<td>EM</td>
<td>Effective Microorganism</td>
</tr>
<tr>
<td>FSI+</td>
<td>Fertilizer Sector Improvement</td>
</tr>
<tr>
<td>GM</td>
<td>Gross Margin</td>
</tr>
<tr>
<td>ha</td>
<td>hectare</td>
</tr>
<tr>
<td>IC</td>
<td>Input Cost</td>
</tr>
<tr>
<td>IFDC</td>
<td>International Fertilizer Development Center</td>
</tr>
<tr>
<td>kg</td>
<td>kilogram</td>
</tr>
<tr>
<td>m</td>
<td>meter</td>
</tr>
<tr>
<td>NPK</td>
<td>Nitrogen, Phosphorus, and Potassium</td>
</tr>
<tr>
<td>NUDP</td>
<td>Non-UDP</td>
</tr>
<tr>
<td>PU</td>
<td>Prilled Urea</td>
</tr>
<tr>
<td>QS</td>
<td>Quantity Sales</td>
</tr>
<tr>
<td>t</td>
<td>ton</td>
</tr>
<tr>
<td>TC</td>
<td>Total Cost</td>
</tr>
<tr>
<td>TP</td>
<td>Total Production</td>
</tr>
<tr>
<td>TSP</td>
<td>Triple Superphosphate</td>
</tr>
<tr>
<td>UDP</td>
<td>Urea Deep Placement</td>
</tr>
<tr>
<td>UP</td>
<td>Unit Area of Product</td>
</tr>
<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
</tr>
<tr>
<td>VS</td>
<td>Value Sales</td>
</tr>
</tbody>
</table>
Introduction

The Fertilizer Sector Improvement (FSI+) project, implemented by the International Fertilizer Development Center (IFDC), is funded by the United States Agency for International Development (USAID) for five years. Following the introduction of maize with urea deep placement (UDP) demonstrations conducted with Syngenta in 2016, farmers requested to learn more about the technology. The 2017 wet season was the first time FSI+ delivered farmer training and established demonstrations with the Shwe Danu Self Help Development Organization in Pindaya Township. Then, the Shwe Danu Self Help Development and Borderless Link organizations provided farmer training in Pindaya, Lawksawk, Kalaw, and Nyaunshwe townships in the 2018 wet season. A total of 295 maize farmers (236 males and 59 females) applied UDP in their maize crop in the 2018 wet season, and data were collected from a sample of 22 (16 males and six females) to assess the benefits derived from UDP. To measure the impact of the technology on maize yield, the project conducted crop cuts with a survey on a random sample of direct beneficiary maize farmers who used UDP in the wet season of 2018. A crop cut area (60 m²) was harvested from each field with UDP and without UDP, threshed, weighed, and moisture measured to calculate yield per hectare at 14% moisture.

Sample Size and Random Sampling of UDP-Adopting Direct Beneficiary Farmers

The list of direct beneficiary farmers¹ who applied UDP in maize was received from the FSI+ extension team. The UDP-adopting beneficiary farmers were sorted by gender, and then using a random integer generator (non-repeating), the random sample numbers were obtained (in ascending number order) by gender. In total, 16 male and six female UDP-adopting farmers were randomly selected from a total of four townships for the crop cut survey (Table 1). The detailed list of direct beneficiary farmers by gender is presented in Appendix 1.

¹ Direct beneficiary farmers are those who attended training. Their names were recorded on attendance sheets.
Table 1. Number of Surveyed Maize Sample Farmers in the 2018 Wet Season

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Region</th>
<th>Project Township</th>
<th>UDP-Adopting Direct Beneficiary Farmers</th>
<th>Surveyed Sample (7% of Total UDP-Adopting Farmers)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>1</td>
<td>Shan (South)</td>
<td>Pindaya</td>
<td>52</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Shan (South)</td>
<td>Lawksawk</td>
<td>102</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>Shan (South)</td>
<td>Kalaw</td>
<td>26</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>Shan (South)</td>
<td>Nyaungshwe</td>
<td>56</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>236</strong></td>
<td><strong>59</strong></td>
</tr>
</tbody>
</table>

Sample Farmers’ Crop Cut Survey

The crop cut survey was conducted during September 2018. The maize crop cut data were collected from 22 sample farmers out of 295 UDP-adopting farmers in Pindaya, Lawksawk, Kalaw, and Nyaungshwe townships (Table 1).

Cultivation Method of Sample Farmers’ Crop Cuts

All UDP-adopting farmers used line sowing as the cultural practice. The spacing was 1 ft (0.3048 m) and row space was 2 ft (0.6096 m). None of the maize farmers used a row-intercropping system with pigeon pea in maize planting. Thus, all UDP-adopting maize farmers planted only maize in the 2018 wet season.

Maize Variety Use by Gender

All sample maize farmers, regardless of gender, used a hybrid maize variety. Two male farmers used seeds from Syngenta Co. Ltd., and the remaining farmers bought/used imported seeds from Thailand and China. The main source of seeds was purchasing from various agro-input companies.

Cropping Pattern of Sample Farmers’ Crop Cuts

The sample maize farmers practiced “nine different cropping patterns” (Table 2). Thirty-one percent of male farmers and 17% of female farmers did not grow a crop after harvesting maize. The majority of female farmers (67% of total female farmers) practiced niger after...
maize. Twelve percent of male farmers practiced those same crops (niger after maize). The remaining female farmers grew onion and niger after the maize crop.

Nineteen percent of male farmers grew onion after maize. One male farmer each planted either tomato; paddy; gram; garlic and gram; groundnut and wheat; or gram, mustard, sesame, and sunflower after maize.

Table 2. Cropping Pattern of Sampled Farmers by Gender

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Count</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>16.7%</td>
<td>.0%</td>
<td>.0%</td>
<td>66.7%</td>
<td>.0%</td>
<td>.0%</td>
<td>.0%</td>
<td>16.7%</td>
<td>.0%</td>
<td>100.0 %</td>
</tr>
<tr>
<td>Male</td>
<td>Count</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>31.2%</td>
<td>6.2%</td>
<td>6.2%</td>
<td>12.5%</td>
<td>6.2%</td>
<td>18.8%</td>
<td>6.2%</td>
<td>.0%</td>
<td>6.2%</td>
<td>100.0 %</td>
</tr>
<tr>
<td>Count</td>
<td>%</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>27.3%</td>
<td>4.5%</td>
<td>4.5%</td>
<td>27.3%</td>
<td>4.5%</td>
<td>13.6%</td>
<td>4.5%</td>
<td>4.5%</td>
<td>4.5%</td>
<td>100.0 %</td>
</tr>
</tbody>
</table>

Basal Fertilizer Use in Maize Production

Table 3 indicates that all female and 94% of male farmers applied basal fertilizer for both UDP and non-UDP in the 2018 wet season maize. Only one male farmer did not use basal fertilizer. The majority of male and female farmers used “compound fertilizer” as a basal fertilizer. Thus, 80% of male and 67% of female farmers used compound fertilizer as a basal fertilizer (Table 4).

Only one female farmer used compound plus triple superphosphate (TSP) as a basal fertilizer. The rest of the female farmers used compound, TSP, and EM bokashi as a basal fertilizer. One male farmer each used “TSP plus EM bokashi,” “compound plus prilled urea,” and “compound plus TSP and EM bokashi” as a basal fertilizer.
Table 3. Basal Fertilizer Use in UDP and Non-UDP by Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Count</th>
<th>Basal Used</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>6</td>
<td>100%</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Male</td>
<td>15</td>
<td>93.8%</td>
<td>1</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>95.5%</td>
<td>1</td>
<td>4.5%</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 4. Type of Basal Fertilizer Used in UDP and Non-UDP by Gender

<table>
<thead>
<tr>
<th>Type of Basal Fertilizer</th>
<th>NPK</th>
<th>NPK+PU</th>
<th>NPK+TSP</th>
<th>NPK+Bokashi+TSP</th>
<th>TSP+Bokashi</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>66.7%</td>
<td>.0%</td>
<td>16.7%</td>
<td>16.7%</td>
<td>.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Count</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>80.0%</td>
<td>6.7%</td>
<td>.0%</td>
<td>6.7%</td>
<td>6.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Count</td>
<td>12</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>76.2%</td>
<td>4.8%</td>
<td>4.8%</td>
<td>9.5%</td>
<td>4.8%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Prilled Urea Use in Non-UDP Plots and UDP and Non-UDP Land

Regardless of gender, all farmers used prilled urea when they earthed up the non-UDP plots in the 2018 wet season. The female sample farmers used a higher rate of prilled urea (154 kg/ha) than male sample farmers (135 kg/ha) (Table 5).

Both UDP and non-UDP land areas of male farmers are larger than the land size of female farmers. For example, the non-UDP land of male farmers is nearly double of the land size of female farmers (Table 5).
Table 5. Prilled Urea (kg/ha) Use on UDP and Non-UDP Land

<table>
<thead>
<tr>
<th>Gender</th>
<th>Mean (kg/ha)</th>
<th>PU Price ($/kg)</th>
<th>NUDP (ha)</th>
<th>UDP (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>154.3750</td>
<td>0.3467</td>
<td>2.29283</td>
<td>0.069</td>
</tr>
<tr>
<td>Male</td>
<td>135.0781</td>
<td>0.3556</td>
<td>4.22438</td>
<td>0.09</td>
</tr>
<tr>
<td>Total</td>
<td>140.3409</td>
<td>0.3532</td>
<td>3.69759</td>
<td>0.084</td>
</tr>
</tbody>
</table>

Mean Cost of Total Fertilizer in UDP and Non-UDP

On average, the maize sample farmers used 143 kg of urea briquettes per hectare and 140 kg of prilled urea per hectare in the 2018 wet season. Some farmers used other fertilizers in non-UDP to improve productivity. The average total fertilizer cost (basal + PU + other fertilizers) for non-UDP ($106.70/ha) was a little higher than the fertilizer cost for UDP ($100.50/ha for basal and urea briquettes) (Table 6). Both male and female farmers had the same cost for fertilizer in UDP, but female farmers had a higher cost for fertilizer in non-UDP (female $109.90 vs. male $105).

Table 6. Mean Cost of Total Fertilizer in UDP and Non-UDP

<table>
<thead>
<tr>
<th>Gender</th>
<th>Total Fertilizer Cost in UDP ($/ha)</th>
<th>Total Fertilizer Cost in NUDP ($/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Mean 100.5267</td>
<td>109.9483</td>
</tr>
<tr>
<td></td>
<td>N 6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation 41.55778</td>
<td>38.77210</td>
</tr>
<tr>
<td>Male</td>
<td>Mean 100.5719</td>
<td>105.5975</td>
</tr>
<tr>
<td></td>
<td>N 16</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>Std. Deviation 39.46865</td>
<td>42.36974</td>
</tr>
<tr>
<td></td>
<td>Mean 100.5595</td>
<td>106.7841</td>
</tr>
<tr>
<td></td>
<td>N 22</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation 39.03714</td>
<td>40.54797</td>
</tr>
</tbody>
</table>
Mechanization in Maize Production

All male and female sample farmers used tractors for land preparation. All female farmers hired a tractor for land preparation, but only 81% of male farmers hired a tractor (Table 7). Thus, 19% of male farmers used their own tractor.

Table 7. Tractor Use in Land Preparation

<table>
<thead>
<tr>
<th>Gender</th>
<th>Count</th>
<th>Use Own Tractor</th>
<th>Use Hired Tractor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Male</td>
<td>16</td>
<td>3</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>3</td>
<td>19</td>
<td>22</td>
</tr>
</tbody>
</table>

No farmer used a harvesting machine in Shan State. All female farmers used a threshing machine with charges (Table 8). Only one male farmer did not use a threshing machine, while the rest used a threshing machine during maize harvesting.

Table 8. Threshing Machine Use in Maize Harvesting

<table>
<thead>
<tr>
<th>Gender</th>
<th>Count</th>
<th>Thresher Use</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Male</td>
<td>16</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>1</td>
<td>21</td>
</tr>
</tbody>
</table>

FSI+ Maize Crop Cut Survey Report | Wet Season 2018
Average Maize Land With and Without UDP and Different Farm Size Groups of Sample Farmers

The average farm size of male and female farmers was 4.31 ha and 2.36 ha, respectively (Table 9). The average UDP land size was higher for male farmers (0.09 ha) than UDP land of female farmers (0.07 ha). The non-UDP farm size of male farmers (4.22 ha) was also greater than the non-UDP farm size of female farmers (2.29 ha).

### Table 9. Average Maize Land (ha) With and Without UDP

<table>
<thead>
<tr>
<th></th>
<th>UDP Land (ha)</th>
<th>NUDP (ha)</th>
<th>Total Land (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>.06900</td>
<td>2.29283</td>
<td>2.36150</td>
</tr>
<tr>
<td>N</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>.09000</td>
<td>4.22438</td>
<td>4.31425</td>
</tr>
<tr>
<td>N</td>
<td>16</td>
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<td>16</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<td></td>
</tr>
<tr>
<td>Mean</td>
<td>.08427</td>
<td>3.69759</td>
<td>3.78168</td>
</tr>
<tr>
<td>N</td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
</tbody>
</table>

The majority of both male and female farmers were small land holders (half of female farmers and 44% of male farmers) (Table 10). Only one female farmer was a marginal land holder. A higher percentage of male farmers owned medium- and large-sized land than female farmers. One female farmer was a medium land holder, and one female farmer was a large land holder.

### Table 10. Farm Size Groups by Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Female</th>
<th>Count</th>
<th>Marginal</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
<th>Total</th>
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<tr>
<td>%</td>
<td></td>
<td>1</td>
<td>16.7%</td>
<td>50.0%</td>
<td>16.7%</td>
<td>16.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Count</td>
<td></td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>%</td>
<td></td>
<td>1.67%</td>
<td>50.0%</td>
<td>16.7%</td>
<td>16.7%</td>
<td>16.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Male</td>
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<td>0</td>
<td>7</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>%</td>
<td></td>
<td>0.0%</td>
<td>43.8%</td>
<td>25.0%</td>
<td>31.2%</td>
<td>100.0%</td>
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</tr>
<tr>
<td>Count</td>
<td></td>
<td>1</td>
<td>10</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>22</td>
</tr>
<tr>
<td>%</td>
<td></td>
<td>4.5%</td>
<td>45.5%</td>
<td>22.7%</td>
<td>27.3%</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>

Marginal = 0.04-0.81 ha, Small = 0.82-2.02 ha, Medium = 2.03-4.05 ha, Large = above 4.05 ha.
Mean Yield of UDP and Non-UDP, Percentage Yield Increase, and Percentage of Total Production Sold

The mean UDP yield of male and female farmers was nearly the same (female 6.61 t/ha vs. male 6.55 t/ha) in the 2018 wet season. But male farmers received a higher yield for non-UDP (male 5.75 t/ha vs. female 5.1 t/ha) than female farmers in wet season maize (Table 11).

With application of UDP, maize yield increased by 40% for female farmers and 16% for male farmers. Overall, maize yield increased by 22.9% due to application of UDP (Table 11).

The sample female farmers sold 88% of their total maize production, while sample male farmers sold 79% of their total production (Table 11).

Table 11. UDP and NUDP Yield, Percentage Yield Increase, and Percentage of Total Production Sold

<table>
<thead>
<tr>
<th>Gender</th>
<th>UDP Yield</th>
<th>NUDP Yield</th>
<th>% Yield Increase</th>
<th>% TP Sold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Mean</td>
<td>6.6150</td>
<td>5.1050</td>
<td>40.1517</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Male</td>
<td>Mean</td>
<td>6.5519</td>
<td>5.7588</td>
<td>16.4625</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>Mean</td>
<td>6.5691</td>
<td>5.5805</td>
<td>22.9232</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
</tbody>
</table>

Mean Yield of UDP and Non-UDP and % Yield Increase by Different Kinds of Basal Fertilizer

The majority of maize farmers, regardless of gender, used compound fertilizer as a basal in the 2018 wet season. The maize yield improved by 21.9% for those farmers who used compound as a basal fertilizer (Table 12).

The mean yields for both UDP (6.43 t/ha) and non-UDP (5.43 t/ha) were higher for the sample farmers who used compound basal fertilizer than those who used other types of basal fertilizer (except yields received by a farmer who used basal TSP and EM bokashi). That farmer received the highest UDP (10.5 t/ha) and non-UDP (9.7 t/ha) yields (Table 12).
A sample farmer who used compound fertilizer and prilled urea as a basal received the negative yield increment (-3.9%).

Table 12. UDP and Non-UDP Yield and Percentage Yield Increase With Various Types of Basal Fertilizer

<table>
<thead>
<tr>
<th>Kind of Basal</th>
<th>UDP Yield</th>
<th>NUDP Yield</th>
<th>% Yield Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPK</td>
<td>Mean</td>
<td>6.4306</td>
<td>5.4356</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>4.5700</td>
<td>4.7600</td>
</tr>
<tr>
<td>NPK+PU</td>
<td>N</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>4.8500</td>
<td>2.3600</td>
</tr>
<tr>
<td>NPK+TSP</td>
<td>N</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>5.7500</td>
<td>5.0400</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>NPK+EM Bokashi+TSP</td>
<td>Mean</td>
<td>10.4800</td>
<td>9.7300</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>TSP+EM Bokashi</td>
<td>Mean</td>
<td>6.3948</td>
<td>5.4238</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>21</td>
<td>21</td>
</tr>
</tbody>
</table>

Mean Seed, Labor, and Threshing Machine Costs and Total Cost of Production

The female sample farmers had higher seed and labor costs than the sample male farmers (Table 13). For example, the mean labor cost for female and male farmers was $107/ha and $89/ha, respectively.

The male sample farmers paid a slightly higher cost for threshing machines. The average total production cost for both UDP and non-UDP was higher for the female sample farmers. For example, the mean total production cost for UDP was $345/ha for female farmers and $310/ha for male farmers. The mean total production cost for non-UDP was $355/ha and $315/ha for female and male farmers, respectively (Table 13).
Table 13. Seed, Labor, and Threshing Machine Costs and Total Production Cost of UDP and Non-UDP

<table>
<thead>
<tr>
<th>Gender</th>
<th>Seed Cost ($/ha)</th>
<th>Labor Cost ($/ha)</th>
<th>Threshing Machine Cost ($/ha)</th>
<th>Total Production Cost in UDP ($/ha)</th>
<th>Total Production Cost in Non-UDP ($/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Mean 48.1733</td>
<td>107.3600</td>
<td>20.4400</td>
<td>345.7767</td>
<td>355.1983</td>
</tr>
<tr>
<td></td>
<td>N 6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Male</td>
<td>Mean 45.2869</td>
<td>89.7456</td>
<td>21.5000</td>
<td>310.0538</td>
<td>315.0812</td>
</tr>
<tr>
<td></td>
<td>N 16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>Mean 46.0741</td>
<td>94.5495</td>
<td>21.2109</td>
<td>319.7964</td>
<td>326.0223</td>
</tr>
<tr>
<td></td>
<td>N 22</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
</tbody>
</table>

*Main Finding*: The female sample farmers had higher production costs in both UDP and non-UDP than male farmers. They received a higher yield in UDP but not in non-UDP. The male sample farmers received a higher non-UDP yield in the 2018 wet season.

Five Data Points and Gross Margin for Sample Farmers’ Crop Cut by Gender

The Gross Margin (GM) for female farmers was higher than for male farmers in UDP (female $697/ha vs. male $639/ha) (Table 14). For non-UDP, the male sample farmers received a higher GM ($557/ha) than the female sample farmers ($547/ha). Due to application of UDP technology, the GM for maize production increased by 27% for female farmers and 15% for male farmers in the 2018 wet season.

Table 14. Five Data Points and Gross Margin for Sample Farmers’ Crop Cuts by Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>UP</th>
<th>TP</th>
<th>QS</th>
<th>VS</th>
<th>IC</th>
<th>GM $/ha</th>
<th>% GM Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>UDP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.44</td>
<td>8.89</td>
<td>7.34</td>
<td>1,131.89</td>
<td>451.14</td>
<td>639</td>
<td>14.7</td>
</tr>
<tr>
<td>Female</td>
<td>0.41</td>
<td>2.73</td>
<td>2.29</td>
<td>361.81</td>
<td>142.79</td>
<td>697</td>
<td>27.4</td>
</tr>
<tr>
<td>Combined</td>
<td>1.85</td>
<td>11.62</td>
<td>9.63</td>
<td>1,493.70</td>
<td>593.93</td>
<td>653</td>
<td>17.9</td>
</tr>
<tr>
<td>NUDP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>67.59</td>
<td>381.18</td>
<td>305.45</td>
<td>46,463.50</td>
<td>20,301.30</td>
<td>557</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>13.76</td>
<td>74.38</td>
<td>46.08</td>
<td>7,489.13</td>
<td>4,562.70</td>
<td>547</td>
<td></td>
</tr>
<tr>
<td>Combined</td>
<td>81.35</td>
<td>455.56</td>
<td>351.53</td>
<td>53,952.63</td>
<td>24,864.00</td>
<td>554</td>
<td></td>
</tr>
<tr>
<td>Whole</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>69.03</td>
<td>390.07</td>
<td>312.79</td>
<td>47,595.39</td>
<td>20,752.44</td>
<td>559</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>14.17</td>
<td>77.11</td>
<td>48.37</td>
<td>7,850.94</td>
<td>4,705.49</td>
<td>551</td>
<td></td>
</tr>
<tr>
<td>Combined</td>
<td>83.20</td>
<td>467.18</td>
<td>361.16</td>
<td>55,446.33</td>
<td>25,457.93</td>
<td>556</td>
<td></td>
</tr>
</tbody>
</table>
Only one male farmer did not use basal fertilizer in maize production, but his GMs for both UDP and non-UDP were higher than the GMs of all types of basal fertilizer users (Table 15). The non-user farmer received a higher GM both with and without UDP ($1,313/ha and $1,068/ha) in the 2018 wet season. He applied prilled urea (247 kg/ha) and cow dung.

Among the basal fertilizer users, the GM with and without UDP ($1,121/ha and $964/ha) for sample farmers who used “TSP and EM bokashi” as a basal was higher than GMs of those who used other types of basal fertilizer (Table 16). The farmers who used compound fertilizer as a basal received the second highest GM with and without UDP ($649/ha and $570/ha).

Because of the lower non-UDP yield (2.36 t/ha) received by a farmer who used compound and TSP as a basal, his GM for non-UDP was negative (-$5/ha).

The GM increase with UDP application was 23% for non-user farmers and 14.4% for basal user farmers in the 2018 wet season.
Table 15. Five Data Points and Gross Margin for Maize Farmers by Type of Basal Fertilizer

<table>
<thead>
<tr>
<th>Basal</th>
<th>UP</th>
<th>TP</th>
<th>QS</th>
<th>VS</th>
<th>IC</th>
<th>GM $/ha</th>
<th>% GM Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>UDP NPK(16)</td>
<td>1.437</td>
<td>8.75</td>
<td>7.02</td>
<td>1,101.04</td>
<td>439.27</td>
<td>649</td>
<td>13.9</td>
</tr>
<tr>
<td>NPK+PU(1)</td>
<td>0.069</td>
<td>0.31</td>
<td>0.31</td>
<td>47.19</td>
<td>21.92</td>
<td>367</td>
<td>-13.0</td>
</tr>
<tr>
<td>NPK+TSP(1)</td>
<td>0.069</td>
<td>0.33</td>
<td>0.33</td>
<td>50.08</td>
<td>25.05</td>
<td>364</td>
<td>7,380.0</td>
</tr>
<tr>
<td>NPK+TSP+BK(2)</td>
<td>0.140</td>
<td>0.79</td>
<td>0.54</td>
<td>81.55</td>
<td>61.36</td>
<td>417</td>
<td>29.1</td>
</tr>
<tr>
<td>TSP+BK(1)</td>
<td>0.069</td>
<td>0.72</td>
<td>0.72</td>
<td>108.22</td>
<td>31.07</td>
<td>1,121</td>
<td>16.3</td>
</tr>
<tr>
<td>Combined(21)</td>
<td>1.78</td>
<td>10.90</td>
<td>8.92</td>
<td>1,388.08</td>
<td>578.67</td>
<td>626</td>
<td>14.4</td>
</tr>
<tr>
<td>NUDP NPK(16)</td>
<td>67.59</td>
<td>377.10</td>
<td>282.25</td>
<td>43,557.70</td>
<td>19,653.17</td>
<td>570</td>
<td></td>
</tr>
<tr>
<td>NPK+PU(1)</td>
<td>2.77</td>
<td>13.16</td>
<td>13.16</td>
<td>1,974.83</td>
<td>808.06</td>
<td>422</td>
<td></td>
</tr>
<tr>
<td>NPK+TSP(1)</td>
<td>3.17</td>
<td>7.48</td>
<td>7.48</td>
<td>1,122.48</td>
<td>1138.40</td>
<td>-5</td>
<td></td>
</tr>
<tr>
<td>NPK+TSP+BK(2)</td>
<td>3.51</td>
<td>16.81</td>
<td>7.63</td>
<td>1,145.00</td>
<td>1390.37</td>
<td>323</td>
<td></td>
</tr>
<tr>
<td>TSP+BK(1)</td>
<td>3.17</td>
<td>30.84</td>
<td>30.84</td>
<td>4,627.83</td>
<td>1572.56</td>
<td>964</td>
<td></td>
</tr>
<tr>
<td>Combined(21)</td>
<td>80.21</td>
<td>445.39</td>
<td>341.36</td>
<td>52,427.84</td>
<td>24,562.56</td>
<td>547</td>
<td></td>
</tr>
<tr>
<td>Whole NPK(16)</td>
<td>69.03</td>
<td>385.85</td>
<td>289.27</td>
<td>44,658.74</td>
<td>20,092.44</td>
<td>572</td>
<td></td>
</tr>
<tr>
<td>NPK+PU(1)</td>
<td>2.83</td>
<td>13.47</td>
<td>13.47</td>
<td>2,022.02</td>
<td>829.98</td>
<td>421</td>
<td></td>
</tr>
<tr>
<td>NPK+TSP(1)</td>
<td>3.24</td>
<td>7.81</td>
<td>7.81</td>
<td>1,172.56</td>
<td>1,163.45</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>NPK+TSP+BK(2)</td>
<td>3.65</td>
<td>17.60</td>
<td>8.17</td>
<td>1,226.55</td>
<td>1,451.73</td>
<td>326</td>
<td></td>
</tr>
<tr>
<td>TSP+BK(1)</td>
<td>3.24</td>
<td>31.56</td>
<td>31.56</td>
<td>4,736.05</td>
<td>1,603.63</td>
<td>967</td>
<td></td>
</tr>
<tr>
<td>Combined(21)</td>
<td>81.99</td>
<td>456.29</td>
<td>350.28</td>
<td>53,815.92</td>
<td>25,141.23</td>
<td>548</td>
<td></td>
</tr>
<tr>
<td>UDP Without basal(1)</td>
<td>0.069</td>
<td>0.7</td>
<td>0.7</td>
<td>105.64</td>
<td>15.26</td>
<td>1,313</td>
<td>23</td>
</tr>
<tr>
<td>NUDP Without basal(1)</td>
<td>1.146</td>
<td>10.16</td>
<td>10.16</td>
<td>1,524.8</td>
<td>301.43</td>
<td>1,068</td>
<td></td>
</tr>
<tr>
<td>Whole Without basal(1)</td>
<td>1.215</td>
<td>10.86</td>
<td>10.86</td>
<td>1,630.44</td>
<td>316.69</td>
<td>1,081</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2. Gross Margin With UDP and -Non-UDP by Type of Basal Fertilizer
## Appendix 1. List of Direct Beneficiaries UDP Farmers for Maize Production (Wet Season 2018)

### Table 1. Direct Beneficiary UDP Male and Female Farmers in Pindaya Township

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Farmer</th>
<th>Village Tract</th>
<th>Village</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U Aung Moe Oo</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>2</td>
<td>U Poe Kyaw</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>3</td>
<td>U Aung Poe Htwe</td>
<td>Inn Nge</td>
<td>Pyin Thar</td>
</tr>
<tr>
<td>4</td>
<td>U Zaw Myo</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>5</td>
<td>U Chit Hlaing</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>6</td>
<td>U Thaung Tun</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>7</td>
<td>U Nyo Phyo</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>8</td>
<td>U Nyo Lwin Thant</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>9</td>
<td>U Myo Min Kyi</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>10</td>
<td>U Kyaw Toe</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>11</td>
<td>U Myo Thant</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>12</td>
<td>U Kan Hla (F-U Kyaw)</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>13</td>
<td>U Aung San</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>14</td>
<td>U Soe Naung Htay</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>15</td>
<td>U Mg Kyi</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>16</td>
<td>U Aung Kyaw Kha</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>17</td>
<td>U San Toe</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>18</td>
<td>U Kan Hla (Yay Phyu)</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>19</td>
<td>U Ye Min Phyo</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>20</td>
<td>U Thet Zaw Tun</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>21</td>
<td>U Thein Shwe</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>22</td>
<td>U Win Naung</td>
<td>Inn Nge</td>
<td>Pyin Thar</td>
</tr>
<tr>
<td>23</td>
<td>U Win Nyunt</td>
<td>Inn Nge</td>
<td>Pyin Thar</td>
</tr>
<tr>
<td>24</td>
<td>U Kyin Aung</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>25</td>
<td>U Mg</td>
<td>Inn Nge</td>
<td>Shwe Pa Htoe (North)</td>
</tr>
<tr>
<td>26</td>
<td>U Mg Win</td>
<td>Inn Nge</td>
<td>Inn Nge</td>
</tr>
<tr>
<td>27</td>
<td>U San Yu Mg</td>
<td>Inn Nge</td>
<td>Inn Nge</td>
</tr>
<tr>
<td>28</td>
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Photo 1. Farmers Participate in Removing Husks from Maize Crop Cuts in Taw Yar Village, Lawksawk Township

Photo 2. Field Day Participation in a Farmer’s Maize Demonstration Plot in Eine Pu Village, Pindaya Township