

Fertilizer Sector Improvement (FSI+)

CROP CUT SURVEY REPORT | DRY SEASON 2019

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Acronyms and Abbreviations

ADS	Agriculture Development Strategy
BMO	Briquetting Machine Owner
BMP	Best Management Practice
BP	Broadcasting Seed
BU	Briquette Urea
DB	Direct Beneficiary
DOA	Department of Agriculture
FSI+	Fertilizer Sector Improvement Project
GM	Gross Margin
ha	hectare
HYV	High-Yielding Variety
IC	Input Costs
IDB	Indirect Beneficiary
IFDC	International Fertilizer Development Corporation
kg	kilogram
LB	Labor
MOP	Muriate of Potash
No.	number
NUDP	Non-UDP
PU	Prilled Urea
QS	Quantity of Sales
t	ton
TP	Transplanting Paddy
TP	Total Production
TSP	Triple Superphosphate
UDP	Urea Deep Placement
UP	Units of Production
USAID	United States Agency for International Development
VS	Value of Sales

Fertilizer Sector Improvement (FSI+) Project

Crop Cut Survey Report

Dry Season 2019

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. Nine field trials to test the adaptation of urea deep placement (UDP) technology were established in the 2014 wet season in Ayeyarwady, Bago, and Yangon regions. Farmer training on Urea Deep Placement (UDP) was started in the summer paddy season 2014/2015 and was provided to 1,465 farmers in 10 townships (from three regions). Another 1,795 farmers in 14 townships from the same three regions received UDP training in the 2015 wet season. In the dry season of 2015/2016, the farmer trainings were provided to 1,795 farmers in 17 townships in the three regions. In the 2016 wet season, the training was broadened to include not only Urea Deep Placement (UDP) but also good seed selection to use the good seeds; and the training was provided to 1,933 farmers in 27 townships. In the dry season of 2016/2017, the training was broadened further to include Best Management Practices (BMPs) and was provided to 944 farmers. To back this up, an additional training to cover the use of good seed and BMPs was delivered to the previous trainees, in addition to and separate from the new batches. This refresher training did not add to the number of direct beneficiary (DB) farmers, as since it was additional training provided to the same farmers.

In the wet season 2017, training was provided to another 914 farmers (732 male farmers and 182 females), as well as and refresher training being was given to past trainees. During the dry paddy season in 2018, 926 farmers (634 males farmers and 292 females farmers) received the training, and 1,361 farmers (875 males farmers and 486 females farmers) attended refresher training. In the wet season 2018, not only the farmers not only in the Delta region but also in Southern Shan State received training. In the FSI project's last season (dry paddy season 2018/2019), a total of 1,324 farmers (1,013 males farmers and 311 females farmers) attended the training for the first time. Therefore, a total of 12,814 farmers (9,243 males and 3,571 females) had attended farmer training by the end of the project. Figure 1 shows the complete

set of farmers trained ~~by gender~~ each season each year by gender. These are the FSI+ direct beneficiaries.

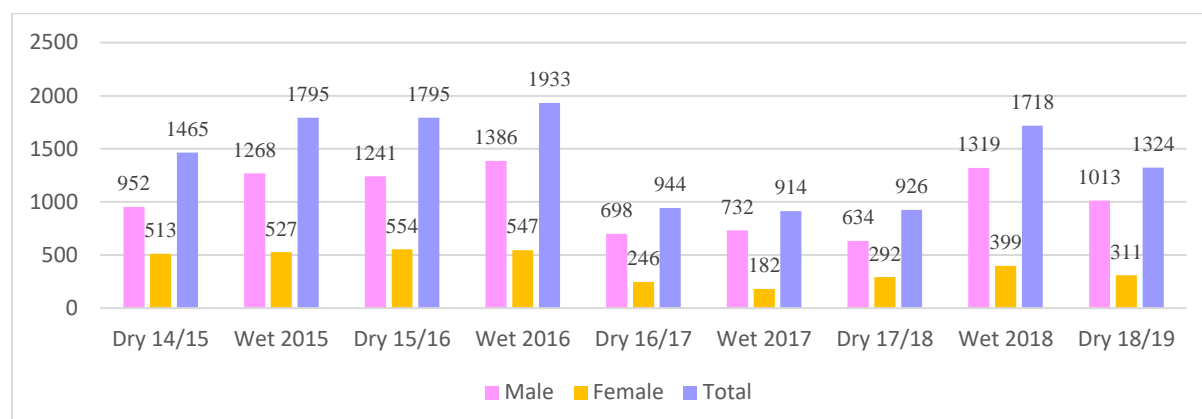


Figure 1. Number of Direct Beneficiary Farmers by Gender (Dry Season 2014/2015 – Dry Season 2018/2019)

The indirect beneficiary (IDB) farmers group includes; (1) farmers who participated in motivational trips and field days of the project; and (2) farmers who bought briquette urea (BU) and applied UDP technology; but did not attend training. **Figure 2** shows the complete set of indirect beneficiaries since project start. In ~~the~~ dry season 2018/2019, 73 IDB farmers (48 males and 25 females) participated in the field days. Among them, ~~eleven~~11 IDB farmers (~~9~~nine males and ~~2~~two females) bought ~~B~~briquette ~~U~~urea (BU) and applied UDP in their paddy fields in ~~the~~ dry paddy season 2018/2019.

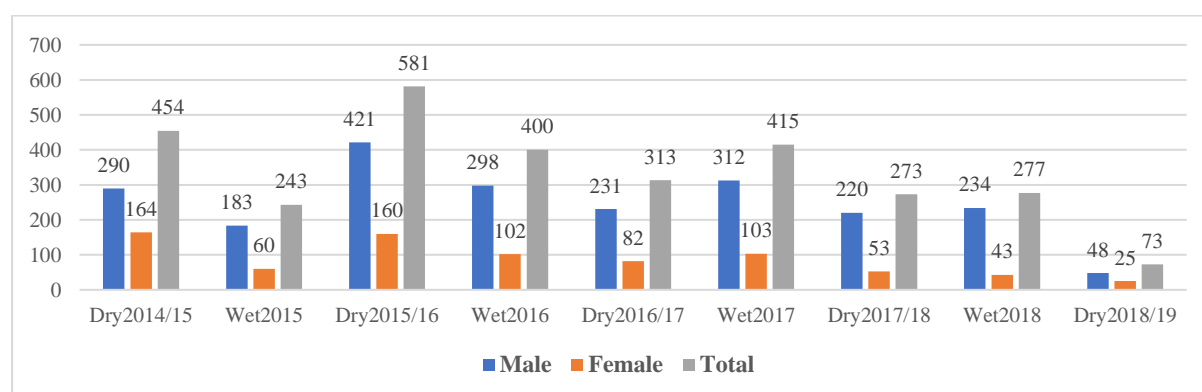


Figure 2. Number of Indirect Beneficiary Farmers by Gender (Dry Season 2014/2015 – Dry Season 2018/2019)

Over the last eight seasons, 90 IDB farmers (76 males and 14 females) applied UDP in a total paddy land area of 191.33 hectares (ha) (**Table 1**).

Table 1. Number of Indirect Beneficiary Farmers (Who Purchased ~~&and~~ Used ~~Briquette Urea~~) by Gender (Wet ~~Season~~ 2015 ~~-~~ Dry ~~Season~~ 2018/~~2019~~)

Season	Male IDB Farmers Male	Female IDB Farmers female	Total IDB Farmers	UDP Land Area (ha)
Dry season 2018/19	9	2	11	39.872
Wet season 2018	5	3	8	23.07
Dry season 2017/18	9	2	11	15.74
Wet season 2017	7	1	8	21.35
Dry season 2016/17	7	0	7	4.38
Wet season 2016	20	4	24	54.28
Dry season 2015/16	15	1	16	26.77
Wet season 2015	4	1	5	5.87
Total	76	14	90	191.33

Sample Size and Random Sampling of Direct Beneficiary Farmers Applying UDP

The ~~name~~-list of direct beneficiary farmers (~~those~~ who attended the farmer trainings and applied UDP in the dry season paddy in 2018/~~2019~~) ~~was~~~~ere~~ obtained from ~~field-monitoring~~ ~~by~~ the sub-grant partners,¹ the FSI~~+~~ extension team, and ~~from~~ key farmer informants. The estimated total number of farmers applying UDP in ~~the~~ dry season 2018/~~2019~~ in three regions (Yangon, Ayeyarwady, and Bago) was 1,099 (~~male~~ 842 ~~males~~ and ~~female~~ 257 ~~females~~) (Table 2). The list was sorted by gender ~~in each~~ ~~and~~ township, and then, ~~by~~ using a random integer generator (non-repeating), a ~~7%~~ ~~seven percent~~ random sample was obtained (in ascending numerical order) by gender ~~in for~~ each township. ~~The result was~~ ~~us~~, ~~63 UDP-~~ ~~adopting~~ ~~male direct~~ beneficiary ~~male~~ farmers and ~~19 UDP-~~ ~~adopting~~ ~~female direct~~ beneficiary ~~female~~ farmers were randomly selected (Table 2).

Due to early harvesting, data ~~from~~ of some male farmers ~~could not be collected~~ from Myanaung and Kangyidaunt townships in Ayeyarwady region ~~could not be collected~~. Overall, ~~data of~~ ~~61 UDP-~~ ~~adopting~~ ~~male~~ beneficiary ~~male~~ farmers and ~~19 UDP-~~ ~~adopting~~ ~~female~~ beneficiary ~~female~~ farmers were collected (Table 2). Data on crop cut paddy yield² with and without UDP, inputs used, wet season paddy cultivated area, percentage of total production sold, farm gate paddy price received, etc., were collected to estimate the gross margin of dry season paddy in 2018/~~2019~~.

¹ ~~A t~~ Total of 13 retailers and ~~2~~ ~~two~~ BMOs ~~that were~~ engaged to implement extension activities within the season, using FSI~~+~~ guidelines.

² Two areas of 10 m² ~~are~~ were selected at random within a field with UDP and an adjacent field without UDP.

Table 2. Direct Beneficiary Farmers Who Used UDP in Dry Season 2018/2019, Sample Size ~~Number~~, and Actual Data Collection

Region	Township	No. of UDP- Adopting Male DB Farmers	No. of UDP- Adopting Female DB Farmers	Total No. of UDP- Adopting DB Farmers	No. of Sample Male DB Farmers	No. of Sample Female DB Farmers	Total No. of Sample DB Farmers	No. Collected of Male Farmers with Data Collected	No. of Female Farmers with Data Collected Female	Total No. of Farmers with Data Collected
Yangon	Kawhmu	41	8	49	3	1	4	3	1	4
	Taikkyi	45	16	61	4	1	5	4	1	5
	Sub-total	86	24	110	7	2	9	7	2	9
Ayeyarwady	Myanaung	38	14	52	3	1	4	2	1	3
	Ingapu	22	5	27	2	0	2	2	0	2
	Kyonmangae	110	23	133	8	2	10	8	2	10
	Kangyidaunt	23	3	26	2	0	2	1	0	1
	Mawgyun	145	56	201	10	4	14	10	4	14
	Maubin	54	14	68	4	1	5	4	1	5
	Pantanaw	25	1	26	2	0	2	2	0	2
	Kyaunggon	20	5	25	1	0	1	1	0	1
	Hinthada	12	1	13	1	0	1	1	0	1
	Sub-total	449	122	571	33	8	41	31	8	39
Bago	Taungoo	45	8	53	4	1	5	4	1	5
	Daik-U	71	34	105	5	2	7	5	2	7
	Sitkwin	70	36	106	5	3	8	5	3	8
	Okpho	41	14	55	3	1	4	3	1	4
	Letpadan	41	10	51	3	1	4	3	1	4
	Thegon	39	9	48	3	1	4	3	1	4
	Sub-total	307	111	418	23	9	32	23	9	32
	Total	842	257	1099	63	19	82	61	19	80

Of the ~~8~~eight ~~indirect beneficiary farmers~~ identified, four ~~indirect beneficiary farmers~~ ~~were~~ selected for sampling from Kyauktan, Letpadan, Thonesei, and Pyapon townships were selected for sampling. However, data could only be collected from two ~~—~~ one male using a mechanized applicator and one male using labor for UDP (**Table 3**).

Table 3. Indirect Beneficiary Farmers Who Used UDP in Wet Season 2018, Sample Size^{Number}, and Actual Data Collection

	BU-Application Method	No. of UDP-Adopting Male IDB Farmers	No. of UDP-Adopting Female IDB Farmers	Total No. of UDP-Adopting IDB Farmers	No. of Sample Male IDB Farmers	No. of Sample Female IDB Farmers	Total No. of Sample IDB Farmers	No. of Collected Male IDB Farmers with Data Collected	No. of Female IDB Farmers with Data Collected Female	Total No. of IDB Farmers with Data Collected
1	Mechanized	2	2	4	1	1	2	1	0	1
2	With labor	3	1	4	1	1	2	1	0	1
	Total indirect beneficiaries	5	3	8	2	2	4	2	0	2

Note: The ~~mechanized~~ IDB farmer ~~using mechanization~~^{selected} was from Kyauktan township, Yangon region, and the IDB farmer using labor was from Letpadan township, Bago region.

Crop cuts ~~data~~ were ~~collected~~^{taken} ~~for~~^{from} two ~~direct~~^{IDB} and two ~~IDB~~^{indirect beneficiary} ~~mechanized~~ farmers ~~using mechanization~~ in Mawgyun township, Ayeyarwady region. ~~who~~ These farmers applied UDP using a ~~an~~ ~~mechanized~~ applicator built by the ~~their~~ ~~briquetting~~ ~~machine owner~~ (BMO).

~~The~~ Crop cuts ~~data~~ were also collected from ~~the both direct~~^{IDB} and ~~IDB~~^{indirect beneficiary} farmers who applied UDP using the FSI+ ~~project~~'s mechanized applicator. In dry paddy season 2018/~~2019~~, one direct beneficiary farmer from Letpadan township and two indirect beneficiary farmers from Thonese and Mawgyun townships used the FSI+ ~~project~~'s mechanized applicator.

Farm Size ~~Groups~~ of the Sample Crop Cut Farmers

Using the Agriculture Development Strategy (ADS) farm size groups³, a higher percentage of the ~~direct beneficiary~~ male and female ~~DB~~ farmers ~~who used~~^{ing} labor ~~into~~ applying UDP (DB LB) in Ayeyarwady region owned small areas of paddy land (Table 4). ~~For example~~^{In} ~~Ayeyarwady~~, 62% of the female ~~farmers~~ and 39% of the male ~~DB LB~~ farmers ~~in~~ ~~Ayeyarwady region~~ were small ~~category~~ land-holders. The majority of ~~direct beneficiary~~ male farmers (71%) and half of ~~the~~ female ~~DB LB~~ farmers in Yangon region ~~owned were~~ medium ~~landholders~~^{category}. Half of ~~DB LB~~^{the} female ~~farmers~~ and 14% of ~~DB LB~~^{the} male ~~DB LB~~ farmers in Yangon ~~owned were~~ large-~~scale~~ paddy land~~holders~~. In Bago-~~region~~, the majority of ~~DB LB~~ female ~~DB LB farmers~~ (44%) ~~were own~~ large-~~scale~~ paddy land~~holders~~, and the majority of ~~DB LB~~ male ~~DB LB farmers~~ (43%) ~~own were~~ small-~~scale~~ paddy

³ Small ~~landholders~~ own less than 5 acres (or 2.02 ha); medium-~~scale~~ ~~landholders farmers~~ own 5 to 10 acres (or 2.03-4.05 ha); and, large-~~scale~~ ~~landholders farmers~~ own more than 10 acres (or ~~above over~~ 4.05 ha).

landholders. The indirect beneficiary (~~IDB LB~~) male farmer ~~who used~~ labor ~~to apply in~~ UDP ~~application (IDB LB)~~ in Yangon region was a small landholder. The ~~IDB LB~~ male ~~IDB LB~~ farmer in Bago region ~~owned the was a~~ large ~~category (over 4.05 ha)~~ paddy landholder.

Half of ~~the DB~~ male ~~DB~~ farmers ~~who used~~ the BMO's mechanized applicator (DB BMO) and all ~~of the male~~ IDB ~~male~~ farmers ~~who used~~ the BMO's mechanized applicator (IDB BMO) in Ayeyarwady region were medium paddy land-holders. The ~~DB~~ female ~~DB~~ farmer in Bago region ~~who used~~ the FSI+ project's mechanized applicator (~~DB FSI~~) was a 'medium land-holder'. The ~~IDB~~ male ~~IDB~~ farmer ~~who used~~ the FSI+ project's mechanized applicator (IDB FSI) in Ayeyarwady region was a small landholder and ~~the IDB FSI farmer~~ in Bago was a large landholder.

Table 4. ~~Different Farm Size Groups~~ of Direct and Indirect Beneficiary Farmers by Gender

Type of Farmer	Region	Gender	Small (<2.02ha), Medium (2.02-4.05) & Large Farm Size (>4.05)			Total
			Small (<2.02 ha)	Medium (2.02-4.05 ha) (no. and %)	Large (>4.05)	
IDB LB (use labor)	Yangon	Male	1 (100%)			1 (100%)
	Bago	Female			1 (100%)	1 (100%)
DB LB (use labor)	Yangon	Female		1 (50%)	1 (50%)	2 (100%)
		Male	1 (14.3%)	5 (71.4%)	1 (14.3%)	7 (100%)
	Ayeyarwady	Female	5 (62.5%)	2 (25%)	1 (12.5%)	8 (100%)
		Male	12 (38.7%)	11 (33.5%)	8 (25.8%)	31 (100%)
	Bago	Female	3 (33.3%)	2 (22.2%)	4 (44.4%)	9 (100%)
		Male	10 (43.5%)	8 (34.8%)	5 (21.7%)	23 (100%)
		Male				
DB BMO Machine	Ayeyarwady	Male		1 (50%)	1 (50%)	2 (100%)
IDB BMO Machine	Ayeyarwady	Male		2 (100%)		2 (100%)
DB FSI Machine	Bago	Female		1 (100%)		1 (100%)
IDB FSI Machine	Ayeyarwady	Male	1 (100%)			1 (100%)
	Bago	Male			1 (100%)	1 (100%)

Average UDP and Non-UDP Dry Season Paddy Land Areas by Gender and Region in Dry Paddy Season 2018/2019

The average UDP land area for both ~~DB LB~~ male and female ~~DB LB~~ farmers ~~was~~ 0.08 ha in Ayeyarwady and Bago ~~regions~~, and ~~it was~~ 0.06 ha in Yangon region (**Table 5**). The average UDP land area of ~~indirect beneficiary (IDB LB)~~ male and female ~~IDB LB~~ farmers was higher than ~~the UDP paddy land size that~~ of ~~DB LB~~ male and female ~~DB LB~~ farmers in

Yangon and Bago ~~regions~~. In Ayeyarwady ~~region~~, the UDP land size (~~1.37 ha~~) of IDB BMO farmers (~~1.37 ha~~) was higher than ~~the land size that~~ of DB BMO farmers (0.35 ha). ~~In Bago,~~ ~~The UDP land size for the male IDB FSI male-farmer was 28.34 ha and it was 0.61 ha for the female DB FSI female-farmer it was 0.61 ha in Bago-region.~~

Among the dry paddy ~~season~~ farmers, the highest UDP (28.34 ha) and ~~non-UDP (NUDP,~~ ~~(35.22 ha) land areas~~ ~~was ere held found in by~~ the ~~male IDB FSI male-farmer in Bago-region.~~ Overall, the F-test ~~presentshows~~ that there was no significant difference in average UDP and NUDP land size among the regions (Ayeyarwady, Bago, and Yangon).

Table 5. ~~Areas of~~ UDP and Non-UDP Land ~~Area in of the~~ Direct and Indirect Beneficiary Farmers by Gender

Region	Type of Farmers	Gender	UDP (ha) (ha and no. of farmers)	NUDP (ha)
Yangon	IDB LB	Male	0.61 (1)	0.93 (1)
	DB LB	Female	.06 (2)	5.00 (2)
		Male	.06 (7)	3.12 (7)
Ayeyarwady	DB LB	Female	.08 (8)	2.2475 (8)
		Male	.08 (31)	3.2897 (31)
	DB BMO machine	Male	.35 (2)	7.335 (2)
Bago	IDB BMO machine	Male	1.375 (2)	1.455 (2)
	IDB FSI machine	Male	.53 (1)	.49 (1)
	IDB LB	Female	2.02 (1)	8.91 (1)
	DB LB	Female	.08 (9)	4.6189 (9)
		Male	.08 (23)	3.1552 (23)
	DB FSI machine	Female	.61 (1)	2.63 (1)
	IDB FSI machine	Male	28.34 (1)	35.22 (1)

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
UDP (ha) * Bago=1, Aye=2, YGN=3	Between Groups	(Combined)	13.767	2	6.884	.759	.471
	Within Groups		779.811	86	9.068		
	Total		793.578	88			
NUDP(ha) * Bago=1, Aye=2, YGN=3	Between Groups	(Combined)	43.839	2	21.920	1.253	.291
	Within Groups		1504.176	86	17.490		
	Total		1548.015	88			

Sources of Seeds and Used of Good Seeds in Dry Paddy Season 2018/2019

Regardless of gender, a higher percentage of DB LB farmers in Yangon and Ayeyarwady ~~regions~~ bought seeds from other farmers to plant dry paddy in 2018/2019. ~~But~~ ~~However~~, the majority of ~~DB LB~~ male and female ~~DB LB~~ farmers in Bago ~~region~~ used their own seeds to

grow dry paddy (**Table 6**). All ~~IDB LB~~ male IDB LB farmers in Yangon bought paddy seeds from other farmers, and all ~~IDB LB~~ female IDB LB farmers in Bago used their own seed in dry paddy season 2018/2019.

All ~~DB BMO~~ male DB BMO farmers in Ayeyarwady ~~region~~ used their own seeds. One of the ~~IDB BMO~~ male IDB BMO farmers bought seeds from other farmers, and the other bought seeds from the Department of Agriculture (DOA) in Ayeyarwady ~~region~~.

The ~~DB FSI~~ female DB FSI farmer in Bago ~~region~~ used her own seeds. The ~~IDB FSI~~ male IDB FSI farmer in Ayeyarwady bought seeds from DOA, and the ~~IDB FSI~~ male IDB FSI farmer in Bago ~~region~~ bought seed from a private seed company.

Table 6. Seed Source for Sampled Farmers in Dry Paddy Season 2018/2019

Type of Farmers	Region	Gender	Seed Sources				
			Total				Total
			Own Seed	Buyough † from Farmers	Buyough † from DOA	Buyough † from Company	
(no. of farmers and %)							
IDB LB	Yangon	Male	Count & %	1 (100%)			1 (100%)
DB LB	Bago	Female	Count & %	1 (100%)			1 (100%)
	Yangon	Female	Count & %	1 (50%)	1 (50%)		2 (100%)
		Male	Count & %	3 (42.9%)	4 (57.1%)		7 (100%)
	Ayeyarwady	Female	Count & %	3 (37.5%)	4 (50%)	1 (12.5%)	8 (100%)
		Male	Count & %	11 (35.5%)	16 (51.6%)	3 (9.7%)	1 (3.2%)
	Bago	Female	Count & %	5 (55.6%)	2 (22.2%)	2 (22.2%)	
Male		Count & %	12 (52.2%)	10 (43.5%)	1 (4.3%)		23 (100%)
DB BMO	Ayeyarwady	Male	Count & %	2 (100%)			2 (100%)
IDB BMO	Ayeyarwady	Male	Count & %	1 (50%)	1 (50%)		2 (100%)
DB FSI	Bago	Female	Count & %	1 (100%)			1 (100%)
IDB FSI	Ayeyarwady	Male	Count & %		1 (100%)		1 (100%)
	Bago	Male	Count & %			1 (100%)	1 (100%)

In **Table 7**, the paddy farmers were categorized into two groups: (1) farmers who bought seeds from other farmers, or from DOA, or seed companies, or certified seeds producers were identified as good seed users; and (2) farmers who used their stored grains from previous cropping seasons to use as seed were identified as 'not good seed users'.

A higher percentage of ~~DB LB~~ male DB LB farmers ~~was~~ are a good seed users than ~~DB LB~~ female DB LB farmers in Yangon and Ayeyarwady ~~regions~~. For example, 57% of ~~DB LB~~ male DB LB farmers in Yangon and 64% of ~~DB LB~~ male DB LB farmers in Ayeyarwady were ~~the~~ good seed users. Over half of both male and female DB LB farmers were not good

seed users in Bago ~~region~~ (Table 7). The ~~IDB LB~~ male ~~IDB LB~~ farmer in Yangon was a good seed user, but the ~~one IDB LB~~ female ~~IDB LB~~ farmer in Bago did not use good seed.

~~Both The DB BMO mechanized~~ male ~~DB BMO~~ farmers in Ayeyarwady and the ~~DB FSI mechanized~~ female ~~DB FSI~~ farmers in Bago region were not good seed users. ~~But~~ However, all ~~IDB mechanized~~ male ~~IDB~~ farmers using mechanization, whether a BMO or FSI machine, in Ayeyarwady and Bago -were good seed users ~~in Ayeyarwady and Bago regions~~.

Table 7. ~~Use of~~ Good Seed Use by Gender ~~and~~ by Types of Farmer

Type of Farmers	Region	Gender	Good Seed User Total		
			No Not Good	Yes Good	Total
(no. of farmers and %)					
IDB LB	Yangon	MaleCount & %		1 (100%)	1 (100%)
	Bago	FemaleCount & %	1 (100%)		1 (100%)
DB LB	Yangon	FemaleCount & %	1 (50%)	1 (50%)	2 (100%)
		MaleCount & %	3 (42.9%)	4 (57.1%)	7 (100%)
	Ayeyarwady	FemaleCount & %	3 (37.5%)	5 (62.5%)	8 (100%)
		MaleCount & %	11 (35.5%)	20 (64.5%)	31 (100%)
	Bago	FemaleCount & %	5 (55.6%)	4 (44.4%)	9 (100%)
		MaleCount & %	12 (52.2%)	11 (47.8%)	23 (100%)
DB BMO	Ayeyarwady	MaleCount & %	2 (100%)		2 (100%)
IDB BMO	Ayeyarwady	MaleCount & %		2 (100%)	2 (100%)
DB FSI	Bago	FemaleCount & %	1 (100%)		1 (100%)
IDB FSI	Ayeyarwady	MaleCount & %		1 (100%)	1 (100%)
	Bago	MaleCount & %		1 (100%)	1 (100%)

Different ~~Seed~~ Treatments by Gender

All ~~DB LB~~ female ~~DB LB~~ farmers and 57% of ~~the DB LB~~ male ~~DB LB~~ farmers in Yangon ~~region~~ used a technique of immersing seed in water to separate the good seed from the bad, or unfilled, seeds (Table 8). ~~Equally h~~ Half of ~~DB LB~~ females ~~DB LB farmers~~ in Ayeyarwady ~~used both~~ soaked seed in water and half soaked seed in salt water for seed selection, while

65% of ~~DB LB~~ male DB LB farmers ~~used~~soaked seed in water. In Bago ~~region~~, ~~there were~~ 56% of ~~DB LB~~ female DB LB farmers ~~who used~~soaked seed in water, and the rest used salt water ~~for as a~~ seed treatment. More than half of ~~the DB LB~~ male DB LB farmers (52.2%) used water ~~for as a~~ seed treatment in Bago ~~region~~.

All ~~IDB LB~~ female IDB LB farmers in Bago and all ~~IDB LB~~ male IDB LB farmers in Yangon region soaked seeds in water before sowing.

In Ayeyarwady, both ~~of the DBs BMO mechanized~~ male DB BMO farmers ~~used salt~~ immersion ~~edion~~ seed in salt water as their seed selection method, but the two ~~IDB BMO mechanized~~ male IDB BMO farmers used the water immersion method. All DB FSI ~~farmers mechanized~~ in Bago applied ~~the~~ water immersion techniques, and all IDB FSI ~~mechanized~~ farmers in Ayeyarwady and Bago ~~regions~~ applied the salt water immersion technique for selecting seeds (Table 8).

Table 8. ~~Different~~ Seed Treatments by Gender in Dry Paddy Season 2018/2019

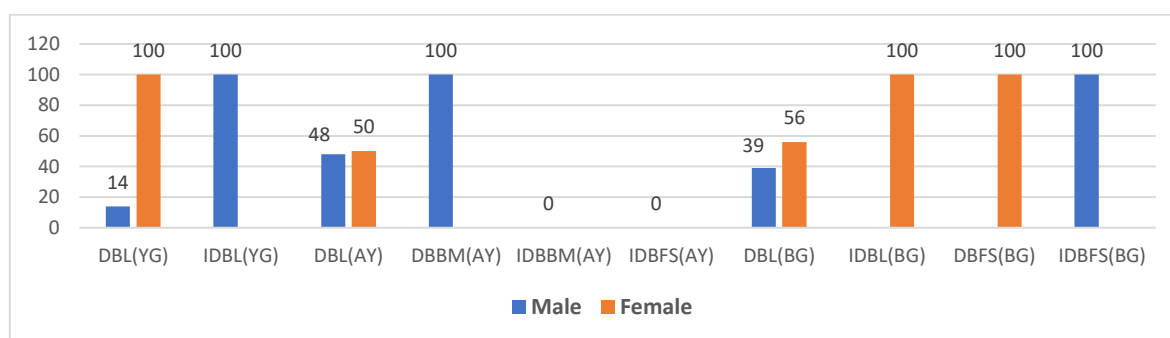
Type of Farmers	Region	Gender	Seed Treatment Total			
			Soak in Water	Soak in Salt Water	Do Nothing	Total
			(no. and %)			
IDB LB	Yangon	Male Count & %	1 (100%)			1 (100%)
DB LB	Bago	Female Count & %	1 (100%)			1 (100%)
	Yangon	Female Count & %	2 (100%)			2 (100%)
		Male Count & %	4 (57.1%)	2 (28.6%)	1 (14.3%)	7 (100%)
	Ayeyarwady	Female Count & %	4 (50%)	4 (50%)		8 (100%)
		Male Count & %	20 (64.5%)	7 (22.6%)	4 (12.9%)	31 (100%)
	Bago	Female Count & %	5 (55.6%)	4 (44.4%)		9 (100%)
		Male Count & %	12 (52.2%)	10 (43.5%)	1 (4.3%)	23 (100%)
DB BMO	Ayeyarwady	Male Count & %		2 (100%)		2 (100%)
IDB BMO	Ayeyarwady	Male Count & %	2 (100%)			2 (100%)
DB FSI	Bago	Female Count & %	1 (100%)			1 (100%)
IDB FSI	Ayeyarwady	Male Count & %		1 (100%)		1 (100%)
	Bago	Male Count & %		1 (100%)		1 (100%)

~~Stored Seed Use~~ of Stored Seed to Grow Paddy in the Next Season

Although all ~~DB LB~~ female DB LB farmers stored paddy for next season, only 14% of male farmers in Yangon stored seed for the next season. Half of ~~DB LB~~ the female and 48% of ~~DB LB~~ male DB LB farmers in Ayeyarwady ~~kept saved~~ paddy for the coming wet season. In

Bago, more than half of ~~DB LB~~the female farmers and 39% of male ~~DB LB~~ farmers kept paddy for ~~the~~ next season. All ~~male~~ IDB LB ~~male~~ farmers in Yangon and ~~female~~ IDB LB ~~female~~ farmers in Bago ~~also kept~~stored paddy for ~~use in~~ the ~~coming~~upcoming season.

In Ayeyarwady, 100-% of ~~male~~ DB BMO ~~mechanized male~~ farmers stored paddy, but ~~male~~ IDB BMO ~~male~~ farmers ~~didn't~~did not keep paddy for ~~the~~ next season. All of ~~DB FSI~~ ~~mechanized~~the female ~~DB FSI~~ farmers and ~~male~~ IDB FSI ~~mechanized male~~ farmers in Bago stored paddy for ~~the~~ next season (**Figure 3**). ~~But~~However, the ~~male~~ IDB FSI ~~mechanized~~ ~~male~~ farmers in Ayeyarwady ~~didn't~~did not keep paddy to grow in ~~the~~ next season.



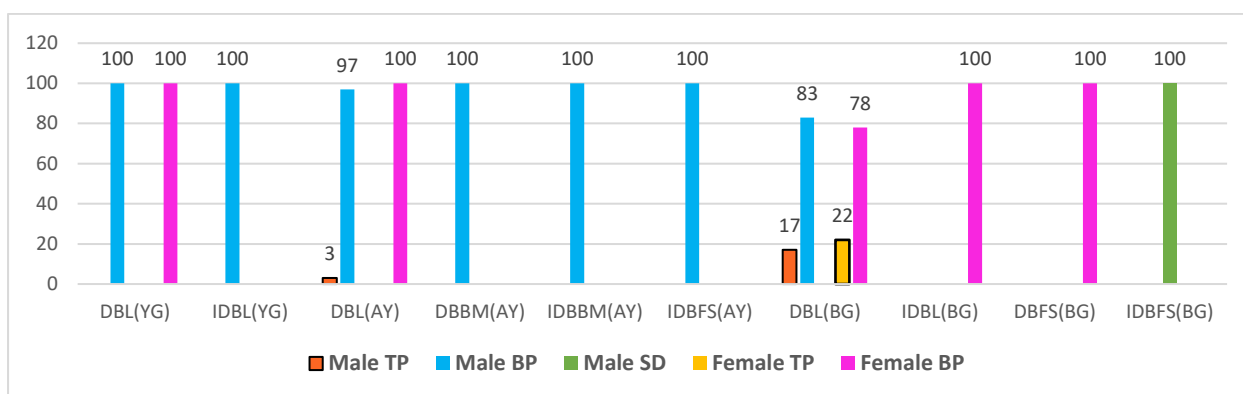
Note: DBL = DB LB, IDBL = IDB LB, DBBM = DB BMO, IDBBM = IDB BMO, DBFS = DB FSI, and IDBFS = IDB FSI, YG = Yangon, AY = Ayeyarwady, and BG = Bago.

Figure 3. Percentage of Farmers Storing Seed for the Next Season

Establishment Practice of Sample Farmers

Due to high labor cost and labor scarcity for transplanting paddy, most farmers preferred to broadcast seeds. Thus, 100% of both ~~DB LB~~male and female ~~DB LB~~ farmers and ~~male~~ IDB LB ~~male~~ farmers in Yangon practiced broadcasting seeds (**Figure 4**). In Ayeyarwady-region, ~~there were~~only 3% of ~~male~~ DB LB ~~male~~ farmers ~~who~~practiced transplanting paddy, while in Bago region ~~it was a little higher at 17% of DB LB~~, ~~slightly more~~ male (~~17%~~) and ~~22% of DB LB~~female (~~22%~~) ~~DB LB~~ farmers ~~practiced~~ transplanting paddy.

All ~~male~~ DB BMO and ~~DB~~ FSI ~~mechanized male~~ farmers and ~~male~~ IDB FSI ~~mechanized~~ ~~male~~ farmers in Ayeyarwady ~~region~~practiced broadcasting seed. All ~~DB~~mechanized female ~~DB FSI~~ farmers ~~who used FSI's machine~~in Bago practiced broadcasting seed. All IDB ~~FSI~~mechanized ~~male farmers who used FSI's machine~~ in Bago used a drum seeder in dry paddy 2018/~~2019~~19 (**Figure 4**).



Note: DBL = DB LB, IDBL = IDB LB, DBBM = DB BMO, IDBBM = IDB BMO, DBFS = DB FSI, and IDBFS = IDB FSI, YG = Yangon, AY = Ayeyarwady, and BG = Bago.

Figure 4. Practice Used to Establish Paddy in Dry Season 2018/19

Seed Rate by Establishment Practice in Dry Season Paddy 2018/19

The male DB LB male farmers in Yangon region used a higher seed rate (about 152 kg/ha) than female DB LB females farmers (about 142 kg/ha) applying the same practice (broadcasting seed). Similarly, the male DB LB male farmers in Ayeyarwady used a higher seed rate than DB LB female DB LB farmers who used the broadcasting practice. In Bago region, DB LB female DB LB farmers used a higher seed rate in broadcasting seed, but male DB LB male farmers used a higher seed rate (133 kg/ha) in transplanting paddy than female DB LB farmers (male 133 kg/ha Vs. female 116 kg/ha).

The Male IDB BMO mechanized male farmers used a higher seed rate (206 kg/ha) in broadcasting seeds than DB BMO male farmers (129 kg/ha) in Ayeyarwady. The female DB FSI mechanized female farmers in Bago region applied seed at a rate of 155 kg/ha for broadcasting. Although the establishment practice is different between the IDB FSI mechanized male farmers in Ayeyarwady (broadcasting seed) and Bago (drum seeder), they used the lowest seed rate (27 kg/ha in Ayeyarwady and 29 kg/ha in Bago, respectively) with hybrid seed (Table 9). Those farmers used 'hybrid seed' and thus their seed rate was the lowest.

The F-test present that there was shows no significant difference in seed use among the regions (Ayeyarwady, Bago, and Yangon).

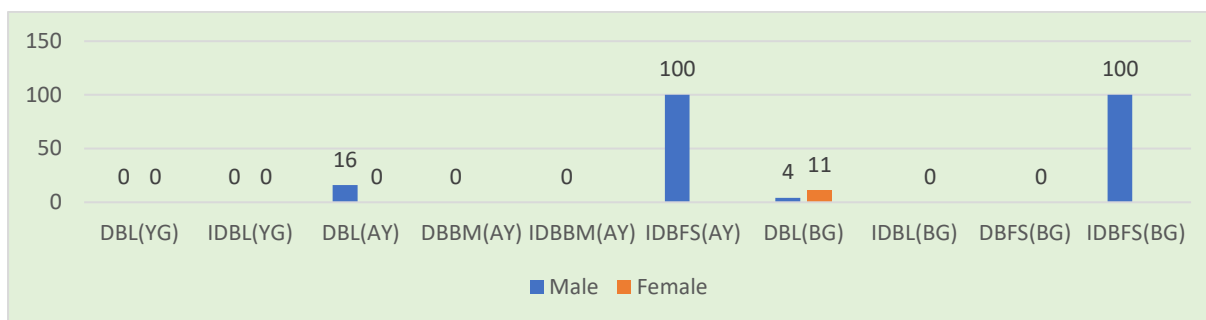
Table 9. Seed Use (kg/ha), and UDP and Non-UDP Yields by Gender by Practice

Region	Type of Farmers	Gender	Practice	Seed Use (Mean kg/ha and No. of farmers)	UDP Yield	NUDP Yield
Yangon	IDB LB	Male	Broadcast	154.8700 (1)	5,902.3300 (1)	5,882.5100 (1)
	DB LB	Female	Broadcast	141.9650 (2)	4,727.9500 (2)	3,278.1050 (2)
Ayeyarwady	DB LB	Male	Broadcast	151.9200 (7)	6,249.5000 (7)	5,194.4271 (7)
		Female	Broadcast	116.1550 (8)	5,889.3375 (8)	4,836.1375 (8)
		Male	Transplant	129.0600 (1)	6,199.1200 (1)	5,650.4700 (1)
			Broadcast	123.2083 (30)	5,930.8087 (30)	5,154.2027 (30)
Bago	DB BMO	Male	Broadcast	129.0600 (2)	6,452.8750 (2)	6,194.7600 (2)
	IDB BMO	Male	Broadcast	206.4900 (2)	6,214.4100 (2)	5,154.0300 (2)
	IDB FSI	Male	Broadcast	26.8400 (1)	6,212.7900 (1)	5,741.9100 (1)
	IDB LB	Female	Broadcast	154.8700 (1)	5,959.7300 (1)	4,326.4500 (1)
	DB LB	Female	Transplant	116.1500 (2)	4,492.9300 (2)	3,646.7800 (2)
			Broadcast	134.9586 (7)	5,645.5700 (7)	5,054.3757 (7)
		Male	Transplant	132.9300 (4)	5,421.2950 (4)	4,531.6150 (4)
			Broadcast	130.6895 (19)	5,853.9063 (19)	4,930.7316 (19)
	DB FSI	Female	Broadcast	154.8700 (1)	6,298.2300 (1)	4,842.0400 (1)
	IDB FSI	Male	Seeder	29.4300 (1)	7,654.1300 (1)	6,550.5000 (1)

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
seed use (kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	5647.025	2	2823.512	1.946	.149
	Within Groups		124773.215	86	1450.851		
	Total		130420.240	88			
UDP yield(kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	956615.679	2	478307.840	.400	.672
	Within Groups		1.030E8	86	1197228.552		
	Total		1.039E8	88			
NUDP yield(kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	2025372.456	2	1012686.228	.873	.421
	Within Groups		9.972E7	86	1159530.464		
	Total		1.017E8	88			

Regardless of the gender, both none of the DB LB and IDB LB farmers in Yangon region didn't use the recommended seed rate in dry paddy season 2018/2019 (Figure 5). Only 16% of DB LB-male DB LB farmers in Ayeyarwady region followed the recommended seed rate, and the rest of the farmers (female DB LB-females, DB BMO, and IDB BMO) in Ayeyarwady region did not use the recommended seed rate. Only 4% of DB LB-male and 11% of DB LB-female DB LB farmers in Bago followed the recommended seed rate. All IDB FSI-mechanized-male IDB FSI farmers in Ayeyarwady and Bago regions followed the recommended rate. The rest of the farmers (IDB LB and DB FSI) farmers in Bago region did not use the recommended seed rate in dry paddy season 2018/19.



Note: DBL = DB LB, IDBL = IDB LB, DBBM = DB BMO, IDBBM = IDB BMO, DBFS = DB FSI, IDBFS = IDB FSI, YG = Yangon, AY = Ayeyarwady, and BG = Bago.

Figure 5. Percentage of Sampled Farmers Using the Recommended Seed Rate (less than 80 kg/ha) in Dry Paddy Season 2018/19

Male DB LB ~~If a farmer~~ used the recommended seed rate (less than 80 kg/ha), in Ayeyarwady and Bago ~~then he/she would~~ received a higher UDP yield than farmers using a higher rate among DB LB male farmers in Ayeyarwady and Bago regions (Table 10). For example, the ~~DB LB~~-male DB LB farmers in Bago who used a seed rate of less than 80 kg/ha received a higher yields in both UDP (7.6 t/ha) and NUDP (6.7 t/ha).

In Yangon and Ayeyarwady ~~regions~~, the ~~DB LB~~-male DB LB farmers ~~with~~ who applied seed ~~overabove~~ the recommended rate received a higher yields in both UDP and NUDP than ~~DB LB~~-female DB LB farmers. Regardless of ~~different the~~ seed rates ~~used~~, ~~DB LB~~-male DB LB farmers generally received a higher yield ~~for~~ with UDP than ~~DB LB~~-female DB LB farmers in Bago ~~region~~. The exception was the NUDP yield for ~~DB LB~~-female DB LB farmers who applied seed ~~overabove~~ the recommended rate; ~~T~~ their yield was higher than their male counterparts.

The ~~DB BMO mechanized~~-male DB BMO farmers who applied seed ~~overabove~~ the recommended rate received higher UDP and NUDP yields than the ~~IDB BMO mechanized~~ male IDB BMO farmers who applied seed ~~overabove~~ the recommended rate in Ayeyarwady ~~region~~. Both UDP and NUDP yields of the ~~IDB FSI mechanized~~-male IDB FSI farmer who used the recommended seed rate ~~yield was~~ ere higher than those of the ~~IDB FSI mechanized~~ female IDB FSI farmer who applied seed ~~overabove~~ the recommended rate in Bago ~~region~~.

Among the regions, the highest UDP yield (7.67 t/ha) was received by ~~DB LB~~-male DB LB farmers ~~with~~ applying the recommended seed rate in Bago, followed by ~~IDB FSI mechanized~~ male IDB FSI farmers ~~with~~ applying the recommended seed rate in Bago. The F-test ~~presentshows that there was~~ no significant difference in ~~botheither the~~ UDP ~~andor~~ NUDP yield among the regions (Ayeyarwady, Bago, and Yangon).

Table 10. UDP ~~&and~~ NUDP Yield (kg/ha) with ~~Different~~by Seed Rates in Dry Paddy Season 2018/19

Region	Type of Farmer	Gender	Seed Rate	UDP Yield (kg/ha) (kg/ha &and Nno. of farmers)	NUDP Yield (kg/ha)
Yangon	IDB LB	Male	Over ≥80 kg/h	5.902.3300 (1)	5.882.5100 (1)
	DB LB	Female	≥Over 80 kg/h	4.727.9500 (2)	3.278.1050 (2)
		Male	≥Over 80 kg/h	6.249.5000 (7)	5.194.4271 (7)
Ayeyarwady	DB LB	Female	≥Over 80 kg/h	5.889.3375 (8)	4.836.1375 (8)
		Male	≥Over 80 kg/h	5.893.8812 (26)	5.105.5362 (26)
			<80 kg/h	6.176.4940 (5)	5.506.5220 (5)
	DB BMO	Male	≥Over 80 kg/h	6.452.8750 (2)	6.194.7600 (2)
	IDB BMO	Male	≥Over 80 kg/h	6.214.4100 (2)	5.154.0300 (2)
	IDB FSI	Male	<80 kg/h	6.212.7900 (1)	5.741.9100 (1)
Bago	IDB LB	Female	≥Over 80 kg/h	5.959.7300 (1)	4.326.4500 (1)
	DB LB	Female	≥Over 80 kg/h	5.539.7725 (8)	4.912.2700 (8)
			<80 kg/h	4.186.6700 (1)	3.376.0300 (1)
		Male	≥Over 80 kg/h	5.692.6505 (22)	4.774.5682 (22)
			<80 kg/h	7.671.0900 (1)	6.769.8600 (1)
	IDB FSI	Female	≥Over 80 kg/h	6.298.2300 (1)	4.842.0400 (1)
	IDB FSI	Male	<80 kg/h	7.654.1300 (1)	6.550.5000 (1)

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
UDP yield(kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	956615.679	2	478307.840	.400	.672
	Within Groups		1.030E8	86	1197228.552		
	Total		1.039E8	88			
NUDP yield(kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	2025372.456	2	1012686.228	.873	.421
	Within Groups		9.972E7	86	1159530.464		
	Total		1.017E8	88			

Application of Basal Fertilizer in Dry Paddy Season 2019

In Yangon ~~region~~, all ~~DB LB~~ males and half of ~~the female~~ DB LB ~~females~~ ~~farmers~~ used basal fertilizer. The majority of ~~DB LB~~ male (61%) and female (75%) ~~DB LB~~ farmers in

Ayeyarwady applied basal fertilizer in dry paddy 2018/19. ~~But~~ However, most of the ~~DB LB~~ male and female ~~DB LB~~ farmers in Bago did ~~n~~ot apply basal fertilizer; (only 22% of males and 11% of females ~~DB LB farmers~~ used basal) (Table 11). ~~All~~ None of the ~~IDB LB~~ male and female ~~IDB LB~~ farmers in Yangon and Bago ~~regions didn't~~ used basal fertilizer, but 100% of ~~male~~ DB BMO and IDB BMO ~~mechanized male~~ farmers in Ayeyarwady used basal fertilizer. While all ~~IDB FSI mechanized male~~ ~~IDB FSI~~ farmers (in Ayeyarwady and Bago) used basal fertilizer, the ~~DB FSI mechanized~~ female ~~DB FSI~~ farmer in Bago did not apply basal fertilizer.

Table 11. Percent~~age~~ of Farmers Who Used Basal Fertilizer in Dry Paddy ~~Season~~ 2018/19

Type of Farmers	Region	Gender	Use Basal Fertilizer <u>Use</u> or <u>Not</u> <u>Total</u>		
			Not Used	Used Basal	Total
(no. of farmers and %)					
IDB LB	Yangon	Male	Count & %	1 (100%)	1 (100%)
	Bago	Female	Count & %	1 (100%)	1 (100%)
DB LB	Yangon	Female	Count & %	1 (50%)	2 (100%)
		Male	Count & %	7 (100%)	7 (100%)
	Ayeyarwady	Female	Count & %	2 (25%)	6 (75%)
		Male	Count & %	12 (38.7%)	19 (61.3%)
		Female	Count & %	8 (88.9%)	1 (11.1%)
	Bago	Male	Count & %	18 (78.3%)	5 (21.7%)
DB BMO	Ayeyarwady	Male	Count & %	2 (100%)	2 (100%)
IDB BMO	Ayeyarwady	Male	Count & %	2 (100%)	2 (100%)
DB FSI	Bago	Female	Count & %	1 (100%)	1 (100%)
IDB FSI	Ayeyarwady	Male	Count & %	1 (100%)	1 (100%)
	Bago	Male	Count & %	1 (100%)	1 (100%)

Types of Basal Fertilizer Used in Dry Paddy Season 2019

In Yangon, half of the ~~DB LB~~ female ~~DB LB~~ farmers and 43% of the ~~DB LB~~ male ~~DB LB~~ farmers used triple superphosphate (TSP) as a basal. ~~43% of the DB LB male DB LB farmers, 14% used NPK as a basal and 43% used other types of fertilizer (e.g., fertilizer combined with herbicide) and 14% used NPK as a basal.~~

In Ayeyarwady, the majority of both ~~DB LB~~ male and female ~~DB LB~~ farmers in Ayeyarwady used TSP, while 22% of ~~DB LB~~ male ~~DB LB~~ farmers in Ayeyarwady also used

TSP with muriate of potash (MOP). In Bago, 17% of ~~DB LB~~ male DB LB farmers in Bago also used 'TSP & MOP' as basal fertilizer, and 11% of ~~DB LB~~ female DB LB farmers used other fertilizers.

All ~~DB BMO mechanized~~ male DB BMO farmers in Ayeyarwady used 'NPK and TSP' together as a basal in Ayeyarwady region. In Ayeyarwady, one of the ~~IDB BMO~~ male IDB BMO farmers used TSP and the other used 'TSP and MOP' together as a basal fertilizer in Ayeyarwady. The ~~IDB FSI mechanized~~ male IDB FSI farmers in Ayeyarwady and Bago regions used 'NPK and TSP' together as basal fertilizer in dry paddy production (Table 12).

Table 12. Types of Basal Fertilizer Used by Gender by Region

Type of Farmer	Region	Gender	Kind of Basal Fertilizer Use										Total
			No Basal	TSP	NPK	TSP + MOP	TSP + Others	TSP + MOP + Others	Others	NPK + MOP	TSP + MOP + Gypsum	NPK + TSP	
			(No. of farmers and %)										
IDB LB	Yangon	Male Count & %	1 (100)										1
	Bago	Female Count & %	1 (100)										1
DBs LB	Yangon	Female Count & %	1 (50)	1 (50)									2
		Male Count & %		3 (42.9)	1 (14.2)			3 (42.9)				7	
	Ayeyarwady	Female Count & %	2 (25)	3 (37.5)		1 (12.5)	0	0	1 (12.5)	0	1 (12.5)	0	8
		Male Count & %	12 (38.7)	7 (22.6)		7 (22.6)	1 (3.2)	1 (3.2)	1 (3.2)	1 (3.2)	0	1 (3.2)	31
	Bago	Female Count & %	8 (88.9)						1 (11.1)				9
		Male Count & %	18 (78.3)			4 (17.4)			1 (4.3)				23
	DBs BMO	Ayeyarwady	Male Count & %									2 (100)	2
	IDB BMO	Ayeyarwady	Male Count & %		1 (50)		1 (50)						2
DB FSI	Bago	Female Count & %	1 (100)									1	
IDB FSI	Ayeyarwady	Male Count & %									1 (100)	1	
	Bago	Male Count & %									1 (100)	1	

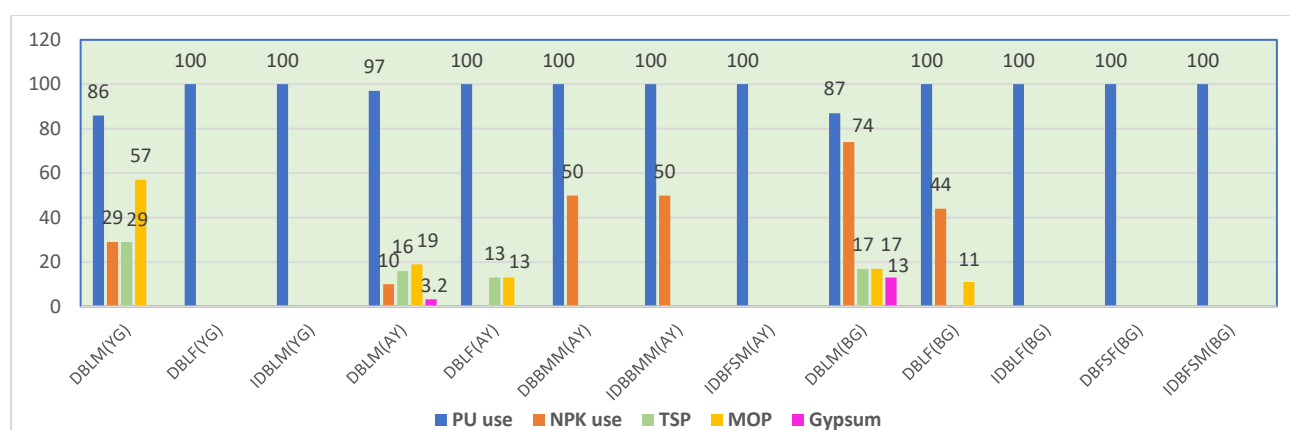
Farmers Using of Prilled Urea, Compound, Phosphate, Potash, and Gypsum in Non-UDP Fields

All ~~DB LB~~ female DB LB farmers in all regions used prilled urea (PU), while 86% of ~~DB LB~~ male DB LB farmers in Yangon, 97% of male DB LB farmers in Ayeyarwady, and 87% of male DB LB farmers in Bago applied PU in dry paddy season 2018/19. All ~~IDB LB~~ males IDB LB farmers in Yangon and ~~IDB LB~~ females IDB LB farmers in Bago used PU in dry paddy production. All male DB BMO and IDB BMO ~~mechanized male~~ farmers in

Ayeyarwady applied PU. Similarly, all ~~FSI mechanized indirect beneficiary~~ male and female ~~IDB FSI~~ farmers in Bago and all ~~indirect beneficiary FSI mechanized~~ male ~~IDB FSI~~ farmers in Ayeyarwady applied PU in dry paddy season 2018/19 (Figure 6).

Regarding NPK fertilizer, 29% of ~~male~~ DB LB ~~male~~ farmers in Yangon, 74% of male DB LB farmers and 44% of female DB LB farmers in Bago, and 10% male DB LB farmers in Ayeyarwady used compound fertilizer. Of the male DB ~~BMO~~ and IDB BMO farmers in Ayeyarwady, half of each applied compound fertilizer.

Of those applying TSP, both male (16%) and female (13%) DB LB farmers in Ayeyarwady used TSP in dry paddy season 2018/19. Only the male DB LB farmers in Yangon (29%) and Bago (17%) ~~regions~~ used TSP. In Yangon, 57% of DB LB male farmers used MOP, followed by 19% and 17% of male DB LB farmers in Ayeyarwady and Bago, respectively. In Ayeyarwady and Bago, 13% and 11% of female DB LB farmers, respectively, used MOP in dry paddy season 2018/19.



DBLM = DB LB male, DBLF = DB LB female, DBBMM = DB BMO male, IDBBMM = IDB BMO male, DBFSF = DB FSI female, ~~and~~ IDBFSM = IDB FSI male, YG = Yangon, AY = Ayeyarwady, and BG = Bago.

Figure 6. Fertilizer Applied in Dry ~~Season~~ Paddy Season 2018/19 (as a percentage of farmers)

Rate of Prilled Urea and Compound Fertilizer Use in Non-UDP Fields

The male IDB LB farmers in Yangon used the highest quantity of prilled urea (370 kg/ha) in dry season paddy 2018/19 (**Table 13**). In Ayeyarwady and Bago ~~regions~~, the male DB LB farmers used a higher rate of PU than female DB LB farmers. For example, the PU rates for male and female DB LB farmers in Ayeyarwady were 224 kg/ha and 206 kg/ha, respectively.

The male DB BMO farmers in Ayeyarwady used a higher rate (247 kg/ha) of PU than male IDB BMO farmers (216 kg/ha). The male IDB FSI farmers in Ayeyarwady and Bago used the same rate for PU (247 kg/ha). However, the female IDB FSI farmer in Bago applied a lower rate of PU (123 kg/ha).

Regardless of type of farmer or gender, the majority of farmers used compound fertilizer at a rate of 123 kg/ha in dry paddy season 2018/19. The male DB LB farmers in Bago used a slightly lower rate (120 kg/ha), and the male DB LB farmers in Ayeyarwady used the lowest rate of compound fertilizer (86 kg/ha)

The F-test shows a significant difference in the use of PU at a 1% significance level among the regions. There was no significant difference in the use of compound fertilizer among the regions.

Table 13. Quantity of Prilled Urea and Compound (NPK) Fertilizer Used in Non-UDP Fields and Total Cost Fertilizer

Region	Type of Farmer	Gender	Prilled Urea Use (kg/ha) (kg/ha and no. of farmers)	Compound Use (kg/ha) (kg/ha and no. of farmers)	Total Fertilizer Cost for UDP (\$/ha) (\$/ha and no. of farmers)	Total Fertilizer Cost for NUDP (\$/ha) (\$/ha and no. of farmers)
Yangon	IDB LB	Male Mean & N	370.50 (1)		76.39 (1)	155.08 (1)
	DB LB	Female Mean & N	247.00 (2)		64.73 (2)	99.30 (2)
		Male Mean & N	195.54 (6)	123.50 (2)	87.75 (7)	128.01 (7)
Ayeyarwady	DB LB	Female Mean & N	206.55 (8)		85.28 (8)	123.81 (8)
		Male Mean & N	223.70 (30)	86.45 (3)	84.04 (31)	139.94 (31)
	DB BMO	Male Mean & N	247.00(2)	123.50 (1)	111.62 (2)	189.57 (2)
	IDB BMO	Male Mean & N	216.12 (2)	123.50 (1)	110.21 (2)	153.75 (2)
	IDB FSI	Male Mean & N	247.00 (1)		178.18 (1)	153.63 (1)
Bago	IDB LB	Female Mean & N	185.25 (1)		67.85 (1)	77.54(1)
	DB LB	Female Mean & N	143.56 (8)	123.50 (9)	60.66 (9)	86.62 (9)
		Male Mean & N	164.07 (20)	119.85 (17)	64.43 (23)	126.01 (23)
	DB FSI	Female Mean & N	123.50(1)		56.54 (1)	53.31 (1)
	IDB FSI	Male Mean & N	247.00(1)		109.04 (1)	159.93 (1)

			Sum of Squares	df	Mean Square	F	Sig.
prilled urea(kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	74230.211	2	37115.106	7.481	.001
	Within Groups		396905.171	80	4961.315		
	Total		471135.382	82			
compound (kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	1583.553	2	791.776	.197	.822
	Within Groups		100367.500	25	4014.700		
	Total		101951.053	27			
Total fert cost UDP(\$/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	11592.719	2	5796.360	9.607	.000
	Within Groups		51889.676	86	603.368		
	Total		63482.395	88			
Total fert cost NUDP (\$/ha) * Bago=1,Aye=2, YGN=3	Between Groups	(Combined)	14113.653	2	7056.826	4.444	.015
	Within Groups		136556.258	86	1587.863		
	Total		150669.910	88			

Total Cost of Fertilizer in UDP and Non-UDP Fields

The total cost of fertilizer for UDP is defined as the summation of BU and basal fertilizer costs. The total fertilizer costs for UDP for ~~DB~~-female and male ~~DB~~ farmers in Yangon were \$64/ha and \$87/ha, respectively. The total fertilizer cost for UDP was nearly the same (\$85/ha) for both ~~DB-LB~~-male and female ~~DB LB~~ farmers in Ayeyarwady region (Table 13). The ~~DB-LB~~-female (\$60/ha) and male (\$64/ha) ~~DB LB~~ farmers in Bago spent less on fertilizer for UDP compared with other regions.

~~Both-DB BMO~~ and IDB BMO ~~mechanized~~-male farmers in Ayeyarwady spent the same amount (\$110/ha) for fertilizer (~~\$110/ha~~) in UDP fields. Among the regions, the ~~IDB-FSI mechanized~~-male ~~IDB FSI~~ farmer in Ayeyarwady paid the highest amount for fertilizer (\$178/ha) in UDP. The ~~DB-FSI-mechanized~~-female ~~DB FSI~~ farmer in Bago spent a lower amount (\$56/ha) on fertilizer in UDP than the ~~IDB-FSI-mechanized~~-male ~~IDB FSI~~ farmer (\$109/ha).

The total fertilizer cost ~~in without~~-NUDP for ~~DB-LB~~-male (\$140/ha) and female (\$124/ha) ~~DB LB~~ farmers in Ayeyarwady was higher than that ~~offor~~ ~~DB-LB~~-male and female ~~DB LB~~ farmers in other regions.

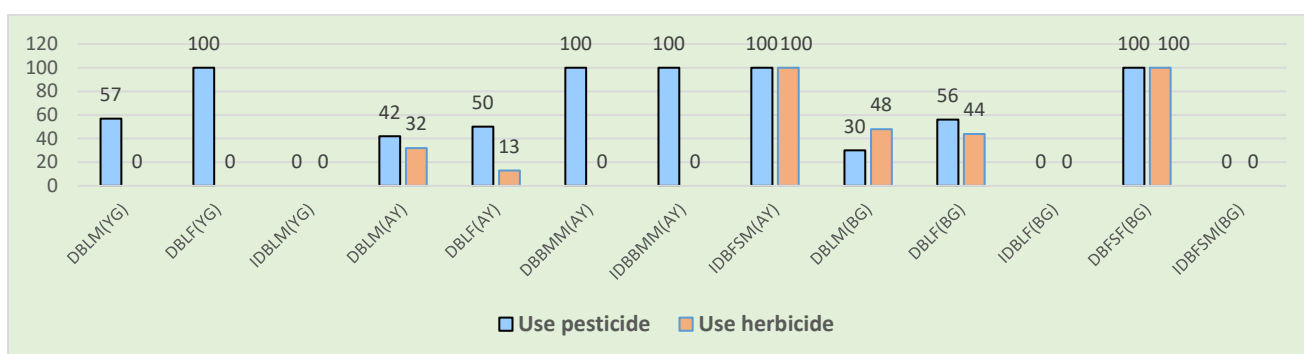
The ~~DB-BMO-mechanized~~-male ~~DB BMO~~ farmers in Ayeyarwady spent the highest amount on fertilizer (\$189/ha) in ~~non~~-NUDP. The ~~non~~-NUDP fertilizer cost (\$153/ha) was the same ~~infor~~ both IDB BMO and IDB FSI ~~mechanized~~-male farmers in Ayeyarwady. The ~~non~~-NUDP fertilizer cost for the ~~IDB-FSI~~-male ~~IDB FSI~~ farmer was triple that ~~offor~~ the ~~DB-FSI~~-female ~~DB FSI~~ farmer in Bago ~~region~~-(Table 13).

The results of the F-test ~~present that there was~~ shows no significant difference in total fertilizer cost for both UDP (at a 1% level) and NUDP (at a 5% level) among the regions.

Use of Pesticide and Herbicide by Gender and Region

A higher percentage of ~~DB LB~~ female DB LB farmers than ~~male DB~~ male farmers in all regions used pesticide (**Figure 7**). For example, 100% of ~~DB LB~~ female DB LB farmers and 57% of ~~DB LB~~ male DB LB farmers in Yangon used pesticide in dry paddy season 2018/19. All ~~direct and indirect BMO mechanized~~ male DB BMO and IDB BMO farmers in Ayeyarwady applied pesticide. The ~~IDB FSI mechanized~~ male IDB FSI farmer in Ayeyarwady and the ~~DB FSI mechanized~~ female DB FSI farmer in Bago used both pesticide and herbicide in dry paddy production (**Figure 7**).

In Ayeyarwady, ~~There were~~ 32% and 13% of ~~DB LB~~ male and female DB LB farmers, respectively, ~~in Ayeyarwady~~ using herbicide. In Bago, 48% of ~~DB LB~~ male and 44% of ~~DB LB~~ female DB LB farmers applied herbicide in dry paddy season 2018/19. ~~Other~~ The remaining groups farmers did n't use herbicide for dry paddy production in 2018/19.



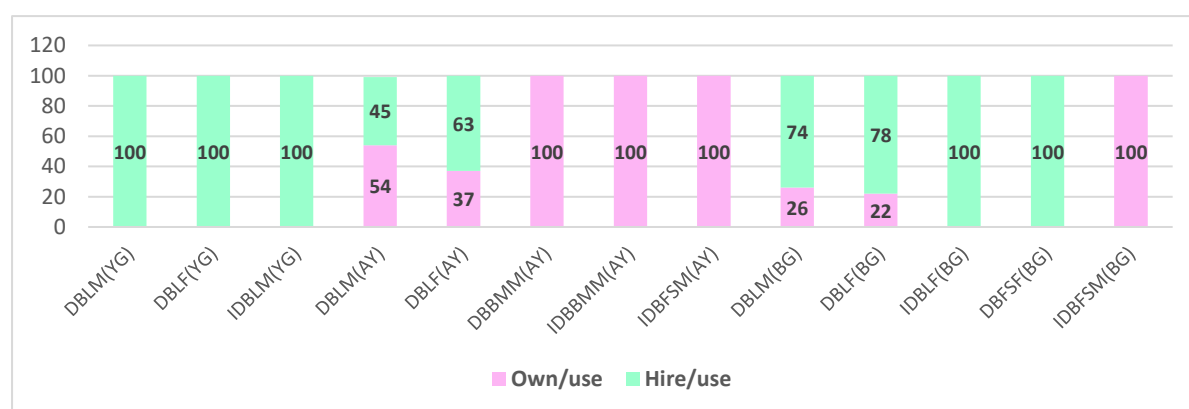
DBLM = DB LB male, DBLF = DB LB female, DBBMM = DB BMO male, IDBMM = IDB BMO male, DBFSF = DB FSI female, IDBFSM = IDB FSI male, YG = Yangon, AY = Ayeyarwady, and BG = Bago.

Figure 7. Pesticide and Herbicide Use Applied in Dry Paddy Season 2018/19

Use of Tractor, Draft Animals, and Harvester

All ~~DB LB~~ female and male DB LB farmers in Yangon, ~~IDB LB~~ male IDB LB farmers in Yangon, ~~IDB LB~~ female IDB LB farmers in Bago, and ~~DB FSI mechanized~~ the female DB FSI farmer in Bago hired a tractor for land preparation. Both ~~the direct and indirect beneficiary BMO mechanized~~ male DB BMO and IDB BMO farmers in Ayeyarwady used their own tractor in Ayeyarwady. ~~Also~~ The ~~IDB FSI mechanized~~ male IDB FSI farmers in Ayeyarwady and Bago regions also used their own tractor for land preparation (**Figure 8**). In Ayeyarwady, 54% of ~~DB LB~~ male and 37% of female DB LB farmers possessed and used their own tractors. The majority of both ~~DB LB~~ male (74%) and female (78%) DB LB farmers in Bago region hired a tractor for land preparation in dry paddy season 2018/19.

None of the farmers used draft animals for land preparation in dry paddy season 2018/19.



DBLM = DB LB male, DBLF = DB LB female, DBBMM = DB BMO male, IDBBMM = IDB BMO male, DBFSF = DB FSI female, IDBFSM = IDB FSI male, YG = Yangon, AY = Ayeyarwady, and BG = Bago.

Figure 8. Use of Tractors (Own and/or Hired Tractor) for Land Preparation

Regardless of gender and/or type of farmer, the majority of farmers in all regions used a combine harvester for dry paddy production in 2018/19. For example, 100% of both DB LB male and female DB LB farmers in Yangon, the and IDB LB male IDB LB farmer in Yangon, and IDB LB female IDB LB farmers in Bago region hired a combine harvester.

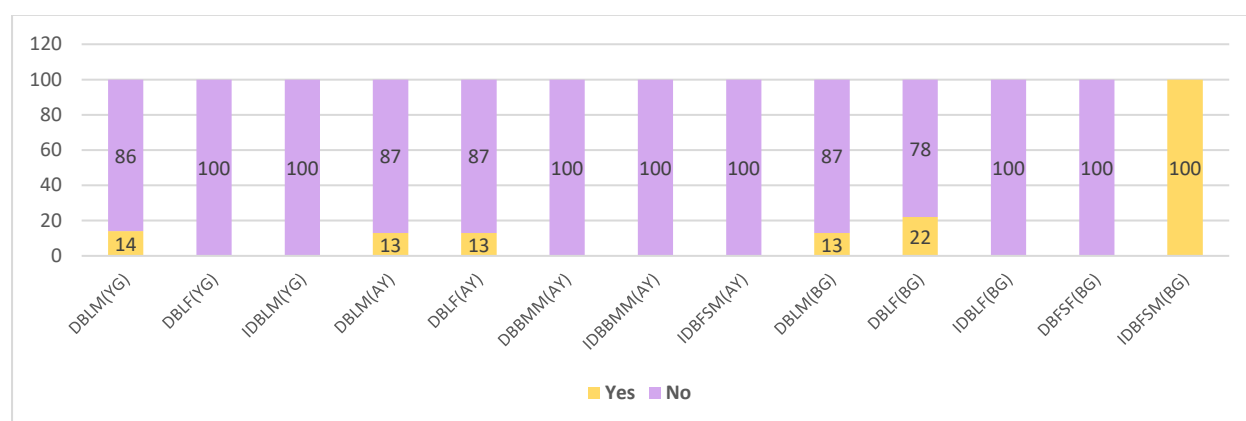
In Ayeyarwady and Bago, 3% of DB LB male farmers in Ayeyarwady and 4% of DB-male DB farmers, respectively, in Bago regions used labor for harvesting paddy. The IDB FSI mechanized-male IDB FSI farmer in Bago did not use a combine harvester (Table 14).

Table 14. Use of a Combine Harvester in Dry Paddy Season 2018/19

Type of Farmers	Region	Gender	Harvester User		
			No (No. of farmers and % Percentage)	Yes	Total
IDB LB	Yangon	Male		1 (100.0%)	1 (100.0%)
	Bago	Female		1 (100.0%)	1 (100.0%)
DB LB	Yangon	Female		2 (100.0%)	2 (100.0%)
		Male		7 (100.0%)	7 (100.0%)
	Ayeyarwady	Female		8 (100.0%)	8 (100.0%)
		Male	1 (3.2%)	30 (96.8%)	31 (100%)
	Bago	Female		9 (100.0%)	9 (100.0%)
		Male	1 (4.3%)	22 (95.7%)	23 (100%)
DB BMO	Ayeyarwady	Male		2 (100.0%)	2 (100.0%)
IDB BMO	Ayeyarwady	Male		2 (100.0%)	2 (100.0%)
DB FSI	Bago	Female		1 (100.0%)	1 (100.0%)
IDB FSI	Ayeyarwady	Male		1 (100.0%)	1 (100.0%)
	Bago	Male	1 (100%)		1 (100%)

Hired Permanent Labor and Contract Service Labor by Gender

Regardless of gender ~~and/or~~ type of farmers, the majority of farmers did ~~n~~^ot hire permanent labor in dry paddy season 2018/19. Only 14% of ~~DB LB~~-males DB LB farmers in Yangon, and 13% of ~~DB LB~~ for both male and female DB LB farmers in Ayeyarwady region hired *sa yin nga*, or permanent farm labor, for dry season paddy 2018/19 (**Figure 9**). In Bago, 13% of ~~DB LB~~-males DB LB farmers and 22% of ~~DB LB~~-female DB LB farmers hired permanent farm labor. The ~~IDB FSI-mechanized~~-male IDB FSI farmer in Bago hired permanent labor for dry paddy production.

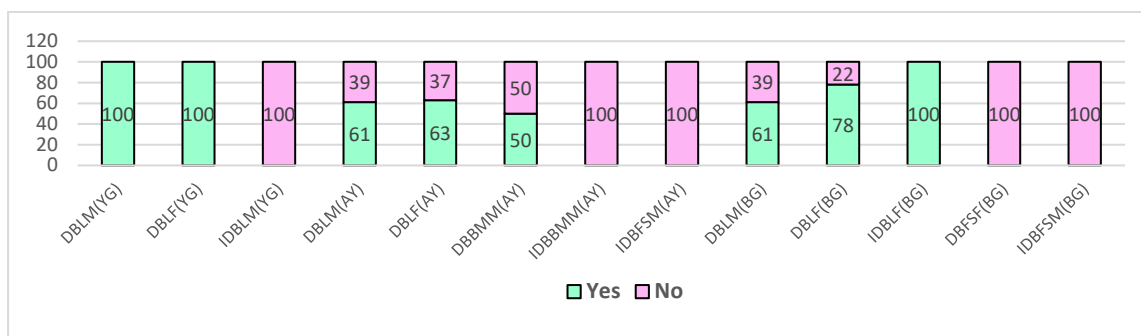


DBLM = DB LB male, DBLF = DB LB female, DBBMM = DB BMO male, IDBBMM = IDB BMO male, DBFSF = DB FSI female, IDBFSM = IDB FSI male, YG = Yangon, AY = Ayeyarwady, and BG = Bago.

Figure 9. Hired Permanent Labor for Dry Paddy Season 2018/19

Contract service labor is mainly used for pulling seedlings, transplanting paddy, and harvesting. All ~~DB LB~~-male and female DB LB farmers in Yangon and the majority of ~~DB LB~~-male and female DB LB farmers in Ayeyarwady and Bago ~~regions~~ hired contract service labor in dry season paddy 2018/19. For example, over 60% of ~~DB LB~~-female and male DB LB farmers in Ayeyarwady and 78% of ~~DB~~-females DB LB and 61% of ~~DB~~-males DB LB in Bago ~~region~~ hired contract service labor (**Figure 10**).

No ~~IDB LB~~-male IDB LB farmers in Yangon, ~~IDB BMO nor IDB FSI-mechanized~~-male IDB BMO and IDB FSI farmers in Ayeyarwady, ~~nor DB FSI-mechanized~~ female ~~nor~~^{and} IDB FSI male IDB FSI farmers in Bago hired contract service labor.

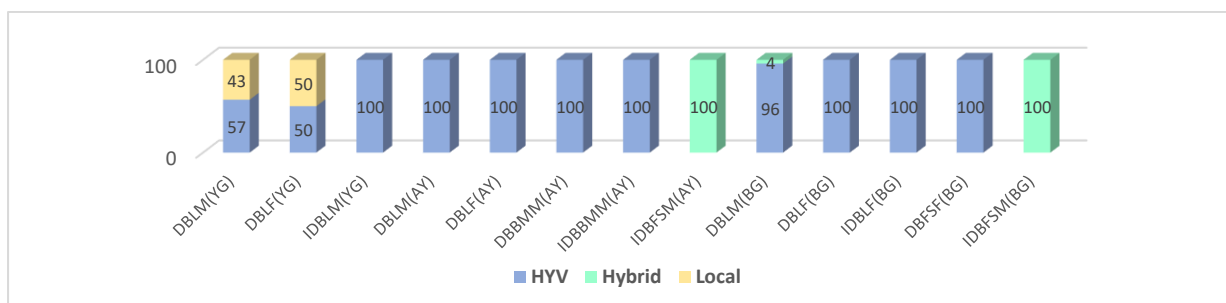


DBLM = DB LB male, DBLF = DB LB female, DBBMM = DB BMO male, IDBBMM = IDB BMO male, DBFSF = DB FSI female, IDBFSM = IDB FSI male, YG = Yangon, AY = Ayeyarwady, and BG = Bago.

Figure 10. Hired Contract Service Labor for Dry Paddy Season 2018/19

Variety Used for Dry Paddy Season 2019

In Yangon, 43% of male farmers and 50% of female farmers in Yangon used a local variety and the rest of maining farmers used high-yielding varieties (HYVs) in dry season 2018/19. Both IDB FSI mechanized male IDB FSI farmers in Ayeyarwady and Bago regions, and 4% of DB LB male DB LB farmers in Bago used a hybrid variety (Figure 11). Regardless of gender and/or type of farmers, the rest of the farmers used HYVs for dry season paddy 2018/19.



DBLM = DB LB male, DBLF = DB LB female, DBBMM = DB BMO male, IDBBMM = IDB BMO male, DBFSF = DB FSI female, IDBFSM = IDB FSI male, YG = Yangon, AY = Ayeyarwady, and BG = Bago.

Figure 11. Kind of Variety Used in Dry Paddy Season 2018/19

Mean Costs for Seeds, Seedbed, and Land Preparation

If Farmers who use their own seeds for dry paddy production, there is incur no cost for seed cost. Among the different types of farmers, the IDB FSI mechanized male IDB FSI farmers in Ayeyarwady (\$79/ha) and Bago (\$86/ha) regions used a hybrid variety and, thus, their had the highest seed cost was the highest. Of the DB LB farmers, the seed cost was a little slightly higher in for female farmers than for male farmers in Yangon and Ayeyarwady regions but in Bago, the male DB LB farmers had a higher seed cost (Table 15).

Due to few farmers transplanting paddy, only ~~DB LB~~ male ~~DB LB~~ farmers in Ayeyarwady (\$19/ha) and ~~DB LB~~ male and female ~~DB LB~~ farmers in Bago region (~~\$33/ha for female and \$49/ha and \$33, for male~~ respectively) incurred costs for seedbed preparation.

Land preparation cost for ~~DB LB~~ male ~~DB LB~~ farmers in Yangon and Bago was higher than for ~~DB LB~~ female ~~DB LB~~ farmers (Table 15). The land preparation cost (~~\$81/ha~~) for ~~IDB LB~~ male ~~IDB LB~~ farmers was the highest in Yangon ~~at \$81/ha compared with farmers in other regions~~. Among ~~the mechanized~~ farmers using mechanization, the land preparation cost for ~~DB BMO~~ male ~~DB BMO~~ farmers in Ayeyarwady was the lowest (\$9.80/ha). The land preparation costs for ~~IDB BMO~~ male ~~IDB BMO~~ and IDB FSI ~~male~~ farmers ~~was~~ \$13/ha and \$12/ha, respectively, in Ayeyarwady. In Bago, the ~~IDB FSI~~ male ~~IDB FSI~~ farmer spent more on land preparation (~~\$28/ha~~) than the ~~DB FSI~~ female ~~DB FSI~~ farmer (~~\$28/ha vs.~~ \$19/ha).

The ~~results of F-~~test shows ~~that there was a~~ significant difference in land preparation costs (at a 5% significant level) among the regions.

Table 15. Mean Cost for Seeds, Seedbed, and Land Preparation

Region	Type of Farmers	Gender	Seed Cost (\$/h)	Seedbed Cost (\$/h)	Land Preparation Cost (\$/h)
			(\$/ha and no. of farmers)		
Yangon	IDB LB	Male Mean & N	36.35 (1)		80.77 (1)
	DBs LB	Female Mean & N	40.39 (1)		34.40 (2)
		Male Mean & N	37.47 (4)		44.72 (7)
Ayeyarwady	DBs LB	Female Mean & N	38.93 (5)		35.23 (8)
		Male Mean & N	33.01 (20)	19.40 (1)	30.59 (31)
	DBs BMO	Male Mean & N			9.85 (2)
	IDB BMO	Male Mean & N	69.46 (2)		13.32 (2)
	IDB FSI	Male Mean & N	79.00 (1)		11.63 (1)
Bago	IDB LB	Female Mean & N			38.77 (1)
	DBs LB	Female Mean & N	30.35 (4)	33.75 (2)	39.23 (9)
		Male Mean & N	34.17 (11)	49.87 (4)	45.72 (23)
	DB FSI	Female Mean & N			19.39 (1)
	IDB FSI	Male Mean & N	86.60 (1)		28.43 (1)

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
seed cost(\$/h) * Bago=1, Aye=2, YGN=3	Between Groups	(Combined)	33.835	2	16.917	.046	.955
	Within Groups		17183.714	47	365.611		
	Total		17217.549	49			
seed bed cost(\$/h) * Bago=1, Aye=2, YGN=3	Between Groups	(Combined)	540.009	1	540.009	.990	.365
	Within Groups		2726.960	5	545.392		
	Total		3266.969	6			
Land preparation(\$/h) * Bago=1, Aye=2, YGN=3	Between Groups	(Combined)	4554.710	2	2277.355	5.581	.005
	Within Groups		35089.712	86	408.020		
	Total		39644.421	88			

Mean Costs of Basal Fertilizer and Briquette Urea Cost

In Yangon and Ayeyarwady ~~regions~~, ~~DB LB~~-male DB LB farmers spent more than females for basal fertilizer ~~than females~~. For instance, ~~DB LB~~-males DB LB farmers in Yangon spent (\$32/ha) on basal fertilizer compared with ~~females~~ (\$19/ha) by females. However, ~~DBs LB~~ female DB LB farmers in Bago spent more for basal fertilizer than males (\$51/ha ~~for females~~ and vs. \$43/ha, for male respectively). The ~~DB BMO mechanized~~-male DB BMO farmers (\$56/ha) in Ayeyarwady had ve a higher basal fertilizer cost at \$56/ha than ~~IDB BMO mechanized~~-male IDB BMO farmers (at \$44/ha). The ~~IDB FSI mechanized~~-male IDB FSI farmer in Bago spent the highest amount on basal fertilizer among all ~~other farmers~~ groups (\$58/ha) (Table 16).

In terms of BU cost, ~~DB LB~~-male and female DB LB farmers spent (\$54/ha) in all regions. The ~~IDB LB~~-male IDB LB farmers in Yangon spent \$76/ha, and ~~IDB LB~~-female IDB LB farmers in Bago spent \$67/ha for BU. The ~~IDB BMO mechanized~~-male IDB BMO farmers haved a higher BU cost (\$65/ha) than male DB BMO ~~male~~-farmers (\$54/ha) in Ayeyarwady. The ~~indirect beneficiaries FSI mechanized~~-male IDB FSI farmer in Ayeyarwady usedincurred the highest BU cost (\$127/ha) in dry paddy season 2018/19.

Mean Costs of Pesticide, Fungicide &, and Herbicide and Irrigation

In Ayeyarwady and Bago ~~regions~~, the ~~DB LB~~-female DB LB farmers spent more on pesticide (including /fungicide) and herbicide than ~~DB LB~~-male DB LB farmers (Table 16). For example, in Ayeyarwady ~~region~~, ~~DB LB~~-female DB LB farmers spent \$33/ha for pesticide &and herbicide, and while ~~DB LB~~-male DB LB farmers spent \$20/ha. In Bago ~~region~~, ~~DB LB~~ female DB LB farmers spent more than male farmers (~~female~~ \$17/ha vs. ~~male~~ \$14/ha, respectively). TheAmong DB LB ~~female~~-farmers in Yangon, female farmers spent only \$3/ha and male farmers spent \$7/ha for pesticide and herbicide. In Ayeyarwady,The ~~IDB BMO mechanized~~-male IDB BMO farmers ~~in Ayeyarwady~~ spent more for pesticide and herbicide (\$30/ha) than ~~DB BMO~~-male DB BMO farmers (\$8/ha). The ~~IDB FSI mechanized~~-male IDB FSI farmer in Ayeyarwady spent more on pesticide and herbicide (\$12/ha) than the ~~DB FSI~~ male DB FSI farmer in Bago (\$5/ha).

The ~~DB LB~~-male DB LB farmers spent more for irrigation in Yangon and Bago ~~regions~~ (Table 16). The irrigation cost for ~~DB LB~~-female DB LB farmers was higher than for male DB LB farmers in Ayeyarwady. The ~~DB BMO mechanized~~-male DB BMO farmers in

Ayeyarwady had the highest irrigation cost (\$43/ha), followed by ~~IDB BMO mechanized~~ male ~~IDB BMO~~ farmers (\$36/ha). The irrigation cost for the ~~DB FSI mechanized~~ female ~~DB FSI~~ farmer was \$26/ha in Bago ~~region~~.

The ~~results of F-~~test shows ~~that there was~~ a significant difference in cost for basal fertilizer (at a 5% level); and pesticide/fungicide and herbicide (at a 5% level) among the regions.

Table 16. Mean Costs of Basal Fertilizer, Briquette Urea, Pesticide, Fungicide, &and Herbicide and Irrigation

Region	Type of Farmer	Gender	Basal Fertilizer Cost (\$/ha)	BU Cost (\$/ha)	Pesticide, Fungicide, &and Herbicide Cost (\$/ha)	Irrigation Cost (\$/ha)
(\$/ha and no. of farmers)						
Yangon	IDB LB	Male	Mean & N	76.3900 (1)		
	DB LB	Female	Mean & N	19.6300 (1)	54.9200 (2)	3.6750 (2)
		Male	Mean & N	32.8229 (7)	54.9200 (7)	7.7200 (4)
Ayeyarwady	DB LB	Female	Mean & N	40.4817 (6)	54.9200 (8)	33.8450 (4)
		Male	Mean & N	47.5174 (19)	54.9200 (31)	20.3421 (19)
	DB BMO	Male	Mean & N	56.7000 (2)	54.9250 (2)	8.4800 (2)
	IDB BMO	Male	Mean & N	44.9100 (2)	65.3050 (2)	30.2900 (2)
	IDB FSI	Male	Mean & N	50.2400 (1)	127.9400 (1)	12.2800 (1)
Bago	IDB LB	Female	Mean & N	67.8500 (1)		3.2300 (1)
	DB LB	Female	Mean & N	51.6900 (1)	54.9200 (9)	17.0417 (6)
		Male	Mean & N	43.7460 (5)	54.9200 (23)	14.6371 (14)
	DB FSI	Female	Mean & N	56.5400 (1)	5.6500 (1)	25.8500 (1)
	IDB FSI	Male	Mean & N	58.1600 (1)	50.8900 (1)	

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
basal fert cost(\$/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	1585.409	2	792.704	3.539	.038
	Within Groups		9408.152	42	224.004		
	Total		10993.560	44			
BU cost (\$/ha) * Bago=1, Aye=2,YGN=3	Between Groups	(Combined)	71.435	2	35.717	.506	.605
	Within Groups		6068.438	86	70.563		
	Total		6139.873	88			
pesthwecicide(\$/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	1414.374	2	707.187	5.102	.009
	Within Groups		7208.204	52	138.619		
	Total		8622.579	54			
Irrigation cost(\$/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	370.947	2	185.473	1.703	.193
	Within Groups		5227.333	48	108.903		
	Total		5598.279	50			

Mean Costs of Contract Service Labor, Permanent Labor, and Total Labor

The ~~DB LB~~ male ~~DB LB~~ farmers in all regions paid more for contract service labor than the ~~DB LB~~ female ~~DB LB~~ farmers. For example, ~~DB LB~~ male ~~DB LB~~ farmers in Yangon paid \$44/ha and ~~DB LB~~ female ~~DB LB~~ farmers paid \$18/ha in dry paddy season 2018/19 (Table

17). In Ayeyarwady ~~region~~, ~~DB-LB~~ male and female DB LB farmers paid \$51/ha and \$26/ha, respectively. The ~~DB-LB~~ male DB LB farmers in Bago paid the highest amount (\$58/ha) for contract service labor in dry paddy season 2018/19. The ~~indirect beneficiary-LB~~ male IDB LB farmers in Bago ~~region~~ spent \$32/ha for contract service labor. The ~~DB-BMO~~ male DB BMO farmer in Ayeyarwady paid the lowest amount (\$4/ha) for contract service labor.

The ~~DB-LB~~ female DB LB farmers in Ayeyarwady and Bago ~~region~~ paid more for ‘permanent labor’ than their male counterparts. For example, ~~DB-LB~~ female and male DB LB farmers in Bago ~~region~~ paid \$59/ha and \$48/ha, respectively, for permanent labor. The ~~DB-LB~~ male DB LB farmers in Yangon spent \$40/ha for permanent labor (**Table 17**). The ~~IDB FSI mechanized~~ male IDB FSI farmer in Bago paid \$23/ha. The remaining farmer groups did not spend anything on ~~hiring~~ permanent labor in dry paddy season 2018/19.

The total labor cost (cost ~~of~~ daily labor, contract service, and permanent labor ~~costs~~) of ~~DB-LB~~ female and male DB LB farmers in Bago (\$71/ha and \$61/ha, respectively) ~~region~~ was higher than ~~that of other DB-LB~~ female and male DB LB farmers in other regions (~~\$71/ha for females and \$61/ha for males~~).

The total labor cost for ~~IDB-LB~~ female IDB LB farmers in Bago (\$63/ha) was almost ~~4~~ four times higher (~~\$63/ha~~) than that of ~~IDB-LB~~ male IDB LB farmers in Yangon (\$16/ha).

The total labor costs for ~~DB-BMO mechanized~~ male DB BMO farmers and ~~IDB-BMO~~ male IDB BMO farmers in Ayeyarwady ~~were~~ as \$18/ha and \$16/ha, respectively. The total labor cost ~~was \$23/ha~~ for the ~~IDB-FSI mechanized~~ male IDB FSI farmer in Bago ~~was \$23/ha and \$8/ha for the IDB-FSI~~ male IDB FSI farmer in Ayeyarwady ~~was \$8/ha~~. The ~~DB-FSI~~ female DB FSI farmer in Bago had the lowest total labor cost (\$3/ha).

The ~~results of F-test~~ presents ~~shows that there was~~ no significant difference in the costs of contract labor, permanent labor, ~~and/or~~ total labor among the regions.

Table 17. Mean Costs of Contract Service Labor, Permanent Labor, and Total Labor

Region	Type of Farmers	Gender	Contract Labor (\$/ha)	Permanent Labor (\$/ha)	Total Labor (\$/ha)
(\$/ha and no. of farmers)					
Yangon	IDB LB	Male	Mean		16.1500 (1)
	DB LB	Female	Mean		18.1700 (2)
		Male	Mean	40.4000 (1)	52.6986 (7)
Ayeyarwady	DB LB	Female	Mean	50.5000 (1)	33.8725 (8)
		Male	Mean	34.7333 (3)	54.6933 (30)
	DB BMO	Male	Mean		18.5800 (2)
Bago	IDB BMO	Male	Mean		16.1500 (2)
	IDB FSI	Male	Mean		8.0800 (1)
	IDB LB	Female	Mean		63.4100 (1)
	DB LB	Female	Mean	59.7500 (2)	71.7078 (9)
		Male	Mean	48.5667 (3)	61.7771 (21)
	DB FSI	Female	Mean		3.2300 (1)
	IDB FSI	Male	Mean	23.2000 (1)	23.1500 (1)

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Contract Labor(\$/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	1636.484	2	818.242	.577	.565
	Within Groups		75116.730	53	1417.297		
	Total		76753.214	55			
Permanent Labor(\$/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	225.586	2	112.793	.291	.755
	Within Groups		3096.181	8	387.023		
	Total		3321.767	10			
Total Labor (\$/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	5413.212	2	2706.606	1.517	.225
	Within Groups		148062.998	83	1783.892		
	Total		153476.210	85			

Mean Cost of Harvesting and Threshing Machine and Total Production With UDP and Non-UDP

The harvesting machine cost for DB LB-female DB LB farmers was higher than that for male DB LB farmers in Yangon and Ayeyarwady-regions. For instance, in Yangon, DB LB female DB LB farmers in Yangon spent \$76/ha for harvesting with a machine, while DB male DB LB farmers spent \$68/ha. The indirect beneficiary-LB-female IDB LB farmers in Bago had a higher harvesting cost (\$73/ha) than IDB LB-female IDB LB farmers in Yangon (\$64/ha). In Ayeyarwady, the harvesting machine cost for DB BMO-male DB BMO farmers was higher than for IDB BMO-male IDB BMO farmers. The DB FSI-female DB FSI farmer in Bago and the IDB FSI-male IDB FSI farmers in Ayeyarwady had the same harvesting and threshing cost (\$72/ha) (Table 18).

The F-test shows that there was no significant difference in harvesting and threshing costs among the regions.

The total production cost was higher for Non-UDP fields than UDP fields in all regions. ~~But except the total production cost for UDP was higher than NUDP~~ for the ~~IDB FSI mechanized~~ female ~~IDB FSI~~ farmer in Bago and the ~~IDB FSI~~ male ~~IDB FSI~~ farmer in Ayeyarwady ~~region~~. In Ayeyarwady, total production cost with UDP for the ~~IDB FSI~~ male ~~IDB FSI~~ farmer (\$374/ha) and ~~IDB BMO~~ male ~~IDB BMO~~ farmers (\$344/ha) was higher than ~~for~~ others types of farmers. ~~Regarding total production cost f~~For Non-UDP fields, ~~IDB BMO~~ male ~~IDB BMO~~ farmers in Ayeyarwady spent the highest (\$388/ha) on total production cost while the female ~~IDB FSI~~ ~~female~~ farmer in Bago spent the lowest (\$180/ha).

The ~~results of F-test presents~~ ~~showed that there was~~ no significant difference in total production cost for ~~both~~ UDP and Non-UDP among the regions in dry paddy season 2018/19.

Table 18. Mean Costs ~~of~~ Harvesting/Threshing Machine and Total Production

Region	Type of Farmers	Gender	Harvesting/ Threshing Machine (\$/ha)	Total Production in <u>With</u> UDP (\$/ha)	Total Production in <u>With</u> NUDP (\$/ha)
(\$/ha and no. of farmers)					
Yangon	IDB LB	Male Mean	64.6200 (1)	274.2800 (1)	352.9700 (1)
	DB LB	Female Mean	76.7300 (2)	226.0000 (2)	260.5700 (2)
Ayeyarwady	DB LB	Male Mean	68.3643 (7)	284.7543 (7)	325.0200 (7)
		Female Mean	77.1350 (8)	289.9400 (8)	328.4638 (8)
	DB BMO	Male Mean	73.9847 (30)	284.0277 (31)	339.9261 (31)
		Male Mean	72.6900 (2)	265.0150 (2)	342.9550 (2)
Bago	IDB BMO	Male Mean	68.6550 (2)	344.6950 (2)	388.2300 (2)
	IDB FSI	Male Mean	72.6900 (1)	374.7900 (1)	350.2400 (1)
	IDB LB	Female Mean	72.6900 (1)	245.9500 (1)	255.6400 (1)
	DB LB	Female Mean	71.9756 (9)	279.1133 (9)	305.0667 (9)
		Male Mean	75.9964 (22)	275.3022 (23)	336.8865 (23)
	DB FSI	Female Mean	72.6900 (1)	183.3500 (1)	180.1200 (1)
	IDB FSI	Male Mean		248.3100 (1)	299.1900 (1)

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Harvest machine(\$/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	205.332	2	102.666	.715	.492
	Within Groups		11916.692	83	143.575		
	Total		12122.024	85			
Total UDP(\$/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	6454.887	2	3227.444	.920	.403
	Within Groups		301839.770	86	3509.765		
	Total		308294.657	88			
Total NUDP(\$/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	9983.540	2	4991.770	1.121	.331
	Within Groups		382986.825	86	4453.335		
	Total		392970.365	88			

Average Yield of UDP and Non-UDP, Farm Gate Price, and %Percentage Increase in Yield by Gender

Generally, paddy yield was higher with UDP than Non-UDP for all types of farmers. Both UDP and NUDP yields for ~~DB-LB~~-male DB LB farmers in all regions ~~was~~ere higher than ~~that~~ose of ~~DB-LB~~-female DB LB farmers (Table 19). In Ayeyarwady and Bago ~~regions~~, UDP yield was over 5.3 t/ha for both ~~DB-LB~~-male and female DB LB farmers. The average UDP yields for ~~DB-LB~~-male and female DB LB farmers in Yangon ~~was~~ere 6.2 t/ha and 4.7 t/ha, respectively.

The ~~IDB-LB~~-male IDB LB farmers in Yangon and ~~IDB-LB~~-female IDB LB farmers in Bago ~~got~~had the same yield with UDP (5.9 t/ha) in dry paddy season 2018/19. ~~Both~~Male IDB BMO and IDB FSI ~~mechanized-male~~ farmers in Ayeyarwady also received the same yield with UDP (6.2 t/ha). The male DB~~direct beneficiary~~ BMO ~~mechanized-male~~ farmers received a ~~little~~slightly higher yield with UDP (6.4 t/ha) in Ayeyarwady.

Among the regions, the male IDB FSI ~~mechanized-male~~ farmer in Bago received the highest UDP and NUDP yields (~~UDP~~at 7.6 t/ha and ~~NUDP~~6.5 t/ha), respectively. The UDP and NUDP yields for the DB FSI ~~mechanized~~ female farmer in Bago ~~were~~as 6.3 t/ha and 4.8 t/ha, respectively.

~~There was a higher percentage yield increase for DB-LB-f~~Female DB LB farmers in Yangon and Ayeyarwady ~~regions~~had a higher percentage yield increase (~~for example~~i.e., female DB LB ~~farmers'~~female's yield increased by 41%, ~~Vs.~~while male's DB LB farmers' yield increased by 22% in Yangon). The percentage yield increase was higher for ~~DB-LB~~-male DB LB farmers in Bago (male 20% ~~V~~vs. female 15%).

With ~~the~~ application of UDP, ~~IDB-LB~~-female IDB LB farmers in Bago increased their yield by 37%, while the ~~DB-FSI-mechanized~~ female DB FSI farmer and ~~IDB-FSI~~-male IDB FSI farmer in Bago region increased their yields by 30% and 16%, respectively (Table 19). The ~~DB-BMO~~-male DB BMO farmers and ~~IDB-BMO~~-male IDB BMO farmers in Ayeyarwady ~~region~~ increased their yields by 4% and 20%, respectively. The percentage yield increased for the ~~IDB-FSI~~-male IDB FSI farmer in Ayeyarwady was 8%.

The average farm gate price was higher for ~~DB-LB~~-male DB LB farmers in Ayeyarwady and Bago ~~regions~~. In Yangon, ~~DB-LB~~-male and female DB LB farmers received \$-0.14/kg and \$0.15/kg, respectively. The male DB BMO and IDB BMO ~~mechanized-male~~ farmers, and the

~~male~~ IDB FSI ~~mechanized male~~ farmer in Ayeyarwady ~~and as well as the DB FSI~~ female ~~DB FSI~~ farmer in Bago ~~region~~ received the same farm gate price (\$0.16/kg) at harvesting time. The ~~IDB FSI~~ male ~~IDB FSI~~ farmer in Bago ~~region~~ ~~got~~ received a ~~little~~ slightly higher price (\$0.17/kg).

The ~~results of F-~~test shows that ~~there was a~~ significant difference in farm gate price at a 1% level among the regions. ~~But~~ However, the UDP yield, NUDP yield, and percentage yield increase ~~by~~ with UDP ~~was~~ ere not significantly different.

Table 19. Average Yield from With UDP and Non-UDP, Farm Gate Price, and %Percentage Increase in Yield by Gender

Region	Type of Farmers	Gender	UDP Yield (kg/ha)	NUDP Yield	Yield Increase (%)	Farm Gate Price (\$/kg)
Yangon	IDB LB	Male Mean & N	5,902.33 (1)	5,882.51 (1)	.34 (1)	.15 (1)
	DB LB	Female Mean & N	4,727.95 (2)	3,278.10 (2)	41.19 (2)	.15 (2)
Ayeyarwady	DB LB	Male Mean & N	6,249.50 (7)	5,194.42 (7)	22.48 (7)	.14 (7)
		Female Mean & N	5,889.33 (8)	4,836.13(8)	23.31 (8)	.16 (8)
	DB BMO	Male Mean & N	5,939.46 (31)	5,170.21(31)	15.53 (31)	.17 (31)
		Male Mean & N	6,452.87 (2)	6,194.76 (2)	4.16 (2)	.16 (2)
	IDB BMO	Male Mean & N	6,214.41 (2)	5,154.03 (2)	20.57 (2)	.16 (2)
Bago	IDB FSI	Male Mean & N	6,212.79 (1)	5,741.91 (1)	8.20 (1)	.16 (1)
	IDB LB	Female Mean & N	5,959.73 (1)	4,326.45 (1)	37.75 (1)	.14 (1)
	DB LB	Female Mean & N	5,389.42 (9)	4,741.57 (9)	15.63 (9)	.13 (9)
		Male Mean & N	5,778.66 (23)	4,861.32 (23)	20.16 (23)	.14 (23)
	DB FSI	Female Mean & N	6,298.23 (1)	4,842.04 (1)	30.07 (1)	.16 (1)
	IDB FSI	Male Mean & N	7,654.13 (1)	6,550.50 (1)	16.85 (1)	.17 (1)

Note: Number in parentheses is the number of farmers.

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
UDP yield(kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	956615.679	2	478307.840	.400	.672
	Within Groups		1.030E8	86	1197228.552		
	Total		1.039E8	88			
NUDP yield(kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	2025372.456	2	1012686.228	.873	.421
	Within Groups		9.972E7	86	1159530.464		
	Total		1.017E8	88			
% yield increase * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	528.958	2	264.479	1.547	.219
	Within Groups		14703.555	86	170.972		
	Total		15232.512	88			
Farmgate (\$/kg) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	.016	2	.008	44.983	.000
	Within Groups		.015	86	.000		
	Total		.031	88			

Average Yield of UDP and Non-UDP, Farm Gate Price, and %Percentage Increase in Yield by Variety

In Yangon ~~region~~, the average yields for both UDP and Non-UDP ~~was~~ were higher for DB LB farmers who used HYVs ~~rather~~ than ~~at the yield with a~~ local variety. For example, the DB LB farmers using HYVs ~~of paddy~~ received 6.6 t/ha, while DB LB farmers ~~with~~ using a local variety received 5 t/ha with UDP in Yangon. The IDB LB farmers in Yangon ~~with~~ using HYV received a yield of 5.9 t/ha with UDP in Yangon (**Table 20**). In Ayeyarwady, the DB LB ~~farmers~~, DB BMO, and IDB BMO farmers ~~used~~ using HYV ~~and~~ received at least 5.9 t/ha in dry paddy ~~season~~ 2018/19, ~~and~~ ~~T~~ the IDB FSI farmer using a hybrid variety received ~~a higher yield (at 6.2 t/ha) in Ayeyarwady~~. The IDB FSI ~~mechanized~~ farmer in Bago ~~who~~ ~~used~~ using a hybrid variety received the highest yield in both UDP (7.6 t/ha) and NUDP (6.5 t/ha).

The ~~yield~~ percentage ~~yield~~ increase with UDP was the highest for HYVs than ~~for~~ other varieties in Yangon, Bago, and Ayeyarwady ~~regions~~.

Regardless of the types of farmers ~~and~~ or variety, the farm gate price for farmers in Ayeyarwady was the same (\$0.16/kg) at ~~the~~ harvesting time (**Table 20**). In Yangon, the DB LB farmers ~~who~~ ~~used~~ using a local variety received a higher farm gate price than farmers ~~with~~ using HYV (\$0.15/kg vs. \$0.14/kg). ~~But~~ ~~However~~, the IDB LB farmers who used ~~a~~ HYV received the same price as the local variety ~~in Yangon~~.

The ~~results of~~ F-test shows ~~that there was a~~ highly significant difference in farm gate price ~~received~~ at ~~a~~ 1% significance ~~level~~ among the regions. ~~But~~ ~~However~~, ~~the~~ percentage yield increase ~~by~~ ~~with~~ UDP was not significantly ~~different~~ among the regions.

Table 20. Average Yield from With UDP and Non-UDP, Farm Gate Price, and %Percentage Increase in Yield by Variety

Region	Type of Farmers	Variety	UDP Yield (kg/ha)	NUDP Yield (kg/ha)	% Yield Increase (%)	Farm Gate Price (\$/kg)
Yangon	IDB LB	HYV Mean & N	5,902.33 (1)	5,882.51 (1)	.34 (1)	.15 (1)
	DB LB	HYV Mean & N	6,619.25 (5)	4,969.77 (5)	37.90 (5)	.14 (5)
		Local Mean & N	5,026.53 (4)	4,517.08 (4)	12.56 (4)	.15 (4)
Ayeyarwady	DB LB	HYV Mean & N	5,929.18 (39)	5,101.68 (39)	17.13 (39)	.16 (39)
	DB BMO	HYV Mean & N	6,452.87 (2)	6,194.76 (2)	4.16 (2)	.16 (2)
	IDB BMO	HYV Mean & N	6,214.41 (2)	5,154.03 (2)	20.57 (2)	.16 (2)
	IDB FSI	Hybrid Mean & N	6,212.79 (1)	5,741.91 (1)	8.20 (1)	.16 (1)
Bago	IDB LB	HYV Mean & N	5,959.73 (1)	4,326.45 (1)	37.75 (1)	.14 (1)
	DB LB	HYV Mean & N	5,628.54 (31)	4,784.17 (31)	19.10 (31)	.13 (31)
		Hybrid Mean & N	6,929.22 (1)	6,175.12 (1)	12.21 (1)	.14 (1)
	DB FSI	HYV Mean & N	6,298.23 (1)	4,842.04 (1)	30.07 (1)	.16 (1)
	IDB FSI	Hybrid Mean & N	7,654.13 (1)	6,550.50 (1)	16.85 (1)	.17 (1)

Note: Number in parentheses is the number of farmers.

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
UDP yield(kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	956615.679	2	478307.840	.400	.672
	Within Groups		1.030E8	86	1197228.552		
	Total		1.039E8	88			
NUDP yield(kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	2025372.456	2	1012686.228	.873	.421
	Within Groups		9.972E7	86	1159530.464		
	Total		1.017E8	88			
% yield increase * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	528.958	2	264.479	1.547	.219
	Within Groups		14703.555	86	170.972		
	Total		15232.512	88			
Farmgate (\$/kg) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	.016	2	.008	44.983	.000
	Within Groups		.015	86	.000		
	Total		.031	88			

Average Yield of UDP and Non-UDP, Farm Gate Price, and %Percentage Increase in Yield by Planting Method

The average UDP yield was the same (5.9 t/ha) for both direct DB LB and IDB indirect beneficiary LB farmers who practiced broadcasting seed in Yangon (Table 21). But However, the average NUDP yield was higher in for IDB LB farmers (5.8 t/ha) than for DB LB farmers (4.7 t/ha) in Yangon region. Thus, the percentage yield increase from with UDP was 26% for direct beneficiaries and 0.34% for indirect beneficiary farmers in Yangon. Both direct DB LB

and ~~indirect beneficiary~~ IDB LB farmers in Yangon received nearly the same farm gate price (\$0.14/kg and \$0.15/kg, respectively) in dry paddy season 2018/19.

In Ayeyarwady, the ~~broadcasting~~ DB LB farmers practicing broadcasting received higher UDP and NUDP yields than ~~transplanting~~ DB LB farmers practicing transplanting. The percentage yield increase ~~when~~ using UDP was 10% for transplanting and 17% for broadcasting. Both transplanting and broadcasting DB LB farmers received nearly the same farm gate price (\$0.17/kg and \$0.16/kg, respectively) in Ayeyarwady. The DB BMO ~~mechanized~~ farmers received ~~a~~ higher UDP and NUDP yields than IDB BMO farmers (~~DB BMO UDP~~ 6.4 t/ha vs. IDB BMO UDP 6.2 t/ha with UDP). The IDB FSI ~~mechanized~~ farmer also received the higher yield level (6.2 t/ha) in dry paddy 2018/19. All ~~mechanized~~ farmers using mechanization in Ayeyarwady ~~got~~ received the same farm gate price (\$0.16/kg).

~~Both~~ UDP and NUDP yields for the ~~direct~~ DB LB and ~~IDB indirect beneficiary~~ LB broadcasting farmers in Bago ~~was~~ ere higher than those of the DB LB transplanting farmers. Both the DB LB direct and ~~IDB indirect beneficiary~~ LB broadcasting farmers received a higher farm gate price (\$0.14/kg) than the DB LB transplanting farmers. Both UDP (7.6 t/ha) and NUDP ~~yield~~ (6.5 t/ha) yields ~~was~~ ere the highest for the IDB FSI ~~mechanized~~ farmer who used a drum seeder in Bago; ~~In addition, the IDB FSI mechanized drum seeder that~~ farmer also received a higher farm gate price (\$0.17/kg) than the DB FSI broadcasting farmer (\$0.16/kg).

The F~~-~~tests show s ~~that there was~~ a significant difference in farm~~_~~gate price (at a 1% level) among the regions.

Table 21. Average UDP and Non-UDP Yield, Farm Gate Price, and %Percentage Increase in Yield by Farm Practice

Region	Type of Farmer	Farm Practice	No. of Farmers	UDP Yield (kg/ha)	NUDP Yield (kg/ha)	% Yield Increase (%)	Farm Gate Price (\$/kg)
Yangon	IDB LB	Broadcast	Mean (N=1)	5,902.33	5,882.51	.34	.15
Ayeyarwady	DB LB	Broadcast	Mean (N=9)	5,911.37	4,768.57	26.64	.14
	DB LB	Transplant	Mean (N=1)	6,199.12	5,650.47	9.71	.17
		Broadcast	Mean (N=38)	5,922.07	5,087.24	17.32	.16
	DB BMO	Broadcast	Mean (N=2)	6,452.87	6,194.76	4.16	.16
	IDB BMO	Broadcast	Mean (N=2)	6,214.41	5,154.03	20.57	.16
	IDB FSI	Broadcast	Mean (N=1)	6,212.79	5,741.91	8.20	.16
Bago	IDB LB	Broadcast	Mean (N=1)	5,959.73	4,326.45	37.75	.14
	DB LB	Transplant	Mean (N=6)	5,111.84	4,236.67	20.83	.13
		Broadcast	Mean (N=26)	5,797.81	4,964.02	18.44	.14
	DB FSI	Broadcast	Mean (N=1)	6,298.23	4,842.04	30.07	.16
	IDB FSI	Seeder	Mean (N=1)	7,654.13	6,550.50	16.85	.17

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
UDP yield(kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	956615.679	2	478307.840	.400	.672
	Within Groups		1.030E8	86	1197228.552		
	Total		1.039E8	88			
NUDP yield(kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	2025372.456	2	1012686.228	.873	.421
	Within Groups		9.972E7	86	1159530.464		
	Total		1.017E8	88			
% yield increase * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	528.958	2	264.479	1.547	.219
	Within Groups		14703.555	86	170.972		
	Total		15232.512	88			
Farmgate (\$/kg) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	.016	2	.008	44.983	.000
	Within Groups		.015	86	.000		
	Total		.031	88			

Average Yield of UDP and Non-UDP, Farm Gate Price, and %Percentage Increase in Yield by Farm Size Group

The average yields for both UDP and NUDP were higher in DB LB medium landholders in Yangon region. In Ayeyarwady, the average yields for both UDP and NUDP were higher in DB LB small landholders. The DB LB large landholders received a higher UDP yield in Bago region (Table 22). The DB BMO large landholder farmers in Ayeyarwady

received a higher UDP yield than ~~the~~ DB BMO medium landholder farmers. The IDB FSI ~~mechanized~~ small holder farmer and ~~the~~ IDB BMO ~~mechanized~~ medium landholder farmers ~~in Ayeyarwady~~ ~~got~~ received the same UDP yield (6.2 t/ha) ~~in Ayeyarwady~~. The IDB FSI ~~mechanized~~ large landholder farmer in Bago (who used a hybrid and a drum seeder) received a higher yields for both UDP and NUDP than the DB FSI farmer (~~IDB FSI UDP yield~~ 7.6 t/ha vs. ~~DB FSI UDP yield~~ 6.3 t/ha with UDP).

In Yangon, the percentage yield increase ~~from~~ with UDP was higher for DB LB small landholders (58%) than for medium (23%) and large ~~landholders~~ (19%) landholders. In Ayeyarwady, the DB LB farmers received the same percentage yield increase (17%) regardless of farm sizes. ~~The~~ UDP and NUDP yields ~~were~~ as the same for DB BMO medium landholder farmers in Ayeyarwady and, thus, the percentage yield increase was zero. ~~But~~ However, the percentage yield increase was 20% for IDB BMO medium landholder farmers in Ayeyarwady. The DB FSI ~~mechanized~~ medium landholder farmer in Bago received a higher percentage yield increase (30%) using with UDP (~~30%~~) ~~in Bago region~~.

Regardless of ~~different~~ farm sizes, the DB LB farmers in Yangon received the ~~nearly~~ same farm gate price (\$0.14/kg). In Ayeyarwady, the DB LB small and large landholder farmers received a higher farm gate price (\$0.17/kg). Regardless of ~~different~~ farm sizes, ~~both~~ DB BMO and IDB BMO ~~mechanized~~ farmers and the IDB FSI ~~mechanized~~ farmer in Ayeyarwady received the same farm gate price (\$0.16/kg). Regardless of ~~different~~ farm sizes, ~~both~~ DB LB and IDB LB farmers in Bago received the same farm gate price (\$0.14/kg). ~~But~~ However, the farm gate price was higher for the DB FSI medium landholder farmer (\$0.16/kg) and the IDB FSI ~~mechanized~~ large landholder farmer (\$0.17/kg) in Bago (\$0.17/kg).

The F-test ~~presents~~ shows ~~that there was~~ a significant difference in farm gate price at a 1% level among the regions.

Table 22. Average UDP & Non-UDP Yield, Farm Gate Price, & %Percentage Yield Increase by Farm Size-Group

Region	Type of Farmers	Farm Size	No. of Farmers	UDP Yield (kg/ha)	NUDP Yield (kg/ha)	% Yield Increase (%)	Farm Gate Price (\$/kg)
Yangon	IDB LB	Small	Mean (N=1)	5,902.33	5,882.51	.34	.15
	DB LB	Small	Mean (N=1)	4,653.45	2,946.28	57.94	.14
		Medium	Mean (N=6)	6,174.66	5,053.75	23.80	.14
		Large	Mean (N=2)	5,750.48	4,824.20	19.50	.14
Ayeyarwady	DB LB	Small	Mean (N=17)	5,992.37	5,142.41	16.86	.17
		Medium	Mean (N=13)	5,855.97	5,071.55	17.41	.16
		Large	Mean (N=9)	5,915.55	5,068.26	17.23	.17
	DB BMO	Medium	Mean (N=1)	6,194.76	6,194.76	.0000	.16
		Large	Mean (N=1)	6,710.99	6,194.76	8.33	.16
	IDB BMO	Medium	Mean (N=2)	6,214.41	5,154.03	20.57	.16
	IDB FSI	Small	Mean (N=1)	6,212.79	5,741.91	8.20	.16
Bago	IDB LB	Large	Mean (N=1)	5,959.73	4,326.45	37.75	.14
	DB LB	Small	Mean (N=13)	5,675.15	4,850.26	17.43	.13
		Medium	Mean (N=10)	5,584.62	4,872.72	17.38	.13
		Large	Mean (N=9)	5,754.54	4,744.88	22.67	.14
	DB FSI	Medium	Mean (N=1)	6,298.23	4,842.04	30.07	.16
	IDB FSI	Large	Mean (N=1)	7,654.13	6,550.50	16.85	.17

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
UDP yield(kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	956615.679	2	478307.840	.400	.672
	Within Groups		1.030E8	86	1197228.552		
	Total		1.039E8	88			
NUDP yield(kg/ha) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	2025372.456	2	1012686.228	.873	.421
	Within Groups		9.972E7	86	1159530.464		
	Total		1.017E8	88			
% yield increase * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	528.958	2	264.479	1.547	.219
	Within Groups		14703.555	86	170.972		
	Total		15232.512	88			
Farmgate (\$/kg) * Bago=1,Aye=2,YGN=3	Between Groups	(Combined)	.016	2	.008	44.983	.000
	Within Groups		.015	86	.000		
	Total		.031	88			

Yield Difference With ~~and Without~~ UDP and NUPD, and Percentage of Total Production Sold by Gender

The yield difference between UDP and ~~Non~~-UDP was higher ~~in~~for female DB LB ~~female~~ farmers in Yangon and Ayeyarwady. For example, the yield differences ~~s~~ for ~~DB LB~~ female and male DB LB farmers in Ayeyarwady ~~was~~ere 1,053 kg and 769 kg, respectively (Table 23). For ~~DB LB~~-male DB LB farmers in Bago, the yield difference between UDP and ~~Non~~-UDP was higher than for female farmers. The male IDB BMO ~~mechanized male~~ farmers in Ayeyarwady ~~got~~had a higher yield difference (1,060 kg) than male DB BMO ~~mechanized male~~ farmers (258 kg). In Bago, the yield difference for the female DB FSI ~~mechanized female~~ farmer was higher than for the male IDB FSI ~~male~~ farmer (~~female~~ 1,456 kg vs. 1,103 kg, respectively).

All ~~indirect beneficiary~~ male and female IDB farmers (whether using labor ~~use~~ or mechanizationed ~~farmers~~) sold 100% of paddy production, while DB BMO and IDB BMO farmers in Ayeyarwady sold 99% and 96%, respectively (Table 23). The percentage sold was higher ~~in~~for male DB LB ~~male~~ farmers than for female DB LB farmers in Yangon and Ayeyarwady ~~regions~~. The same percentage sold (99% of TP) was found in bBoth DB LB male and female DB LB farmers in Bago were found to have sold the same percentage of total production (99%).

The ~~results of F-~~test shows ~~that there was a~~ significant difference at a 5% level in percentage of total paddy production sold among the regions.

Table 23. Yield Gap and Percentage of Total Production Sold at Harvesting Time by Gender

Region	Type	Gender	No. of Farmers	Yield Difference (kg)	% of Total Production Sold
Yangon	IDB LB	Male	Mean (N=1)	19.81	100.00
	DB LB	Female	Mean (N=2)	1,449.85	75.00
		Male	Mean (N=7)	1,055.07	92.85
Ayeyarwady	DB LB	Female	Mean (N=8)	1,053.20	89.10
		Male	Mean (N=31)	769.25	92.62
	DB BMO	Male	Mean (N=2)	258.11	99.00
Bago	IDB BMO	Male	Mean (N=2)	1,060.38	96.50
	IDB FSI	Male	Mean (N=1)	470.88	100.00
	IDB LB	Female	Mean (N=1)	1,633.27	100.00
	DB LB	Female	Mean (N=9)	647.84	99.16
		Male	Mean (N=23)	917.34	99.78
	DB FSI	Female	Mean (N=1)	1,456.20	100.00
	IDB FSI	Male	Mean (N=1)	1,103.63	100.00

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
yield gap bet UDP&NUDP (kg) * Bago=1,Aye=2, YGN=3	Between Groups	(Combined)	457285.402	2	228642.701	.854	.429
	Within Groups		2.304E7	86	267855.364		
	Total		2.349E7	88			
% sell * Bago=1,Aye=2, YGN=3	Between Groups	(Combined)	1252.919	2	626.460	3.239	.044
	Within Groups		16634.472	86	193.424		
	Total		17887.391	88			

Gross Margins

Using the Feed the Future definition, the gross margin is calculated from five data points using the following formula:

$$GM/ha = \frac{(TP \times VS/QS) - IC}{UP}$$

Where: TP = Total Production
 VS = Value of Sales
 QS = Quantity of Sales
 IC = Recurrent Cash Input Costs
 UP = Units (area) of Production

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

The male DB LB ~~male~~ farmers received a higher gross margin (GM) ~~(at \$643/ha)~~ than female DB LB ~~female~~ farmers ~~(at \$546/ha)~~ with UDP (**Table 24**). The male DB LB ~~male~~ farmers

also received a higher GM for NUDP than female DB LB female farmers. The percentage increase of GM with UDP was 63% for female farmers and 46% for male farmers.

Table 24. Gross Margin and 5Five Data Points of Dry Paddy for Direct Beneficiary Farmers (Using Labor) by Gender

	Gender	UP	TP	QS	VS	IC	GM \$/ha (\$/ha)	% GM Increase (%)
UDP	Male (61)	4.78	28,241.46	27,156.88	4,245.59	1,340.92	643.5	46
	Female (19)	1.50	8,316.72	7,732.63	1,149.84	418.67	546.0	63
	Combined (80)	6.28	36,558.17	34,889.51	5,395.43	1,759.58	620.5	50
NUDP	Male (61)	196.40	1,009,520.35	979,275.97	153,724.73	71,642.48	442.1	
	Female (19)	69.55	302,602.97	285,834.76	41,842.04	21,030.78	334.5	
	Combined (80)	265.95	1,312,123.32	1,265,110.73	195,566.77	92,673.26	414.2	
Whole	Male (61)	201.17	1,037,761.80	1,006,432.85	157,970.32	72,983.40	446.9	
	Female (19)	71.05	310,919.69	293,567.39	42,991.87	21,449.45	338.9	
	Combined (80)	272.23	1,348,681.49	1,300,000.24	200,962.20	94,432.85	418.9	

The female IDB LB female farmer with a large-farm-size farm and the male IDB LB male farmer with a small-size farm size received more or less nearly the same GM (\$593/ha for female and \$594/ha, respectively for male) with UDP (Table 25). The male IDB LB small-scaleholder male farmer received a higher GM than the female IDB LB female farmer for with NUDP (\$512/ha for male and \$354/ha, respectively for female). The percentage increase of GM increased with UDP was the highest (68%) for the female farmer.

Table 25. Gross Margin and 5Five Data Points of Dry Paddy for Indirect Beneficiary Farmers (Using Labor) by Gender

	Gender	UP	TP	QS	VS	IC	GM (\$/ha)	% GM Increase (%)
<u>With</u> UDP	Male, BP, SF (1)	0.61	3,584.41	3,584.41	527.18	166.57	594	16
	Female, BP, LF (1)	2.02	12,064.22	12,064.22	1,698.86	497.87	593	68
	Combined (2)	2.63	15,648.63	15,648.63	2,226.05	664.44	593	61
<u>w/o</u> NUDP	Male, BP, SF (1)	0.93	5,477.64	5,477.64	805.63	328.68	512	
	Female, BP, LF (1)	8.91	38,535.21	38,535.21	5,426.46	2,276.98	354	
	Combined (2)	9.84	44,012.86	44,012.86	6,232.09	2,605.66	369	
Total	Male, BP, SF (1)	1.54	9,062.05	9,062.05	1,332.82	495.24	544	
	Female, BP, LF (1)	10.93	50,599.44	50,599.44	7,125.32	2,774.85	398	
	Combined (2)	12.47	59,661.49	59,661.49	8,458.14	3,270.10	416	

BP = Broadcast Paddy; SF = small landholder farmer; LF = large landholder farmer.

In terms of GM for FSI mechanized beneficiary farmers, the IDB Among farmers using the FSI+ project's mechanized applicator, male IDB FSI farmers received a higher GM (USD \$1,053/ha) than the DB LBFSI female farmer (USD \$802/ha) with UDP (Table 26).

Similarly, without NUDP, the IDB FSI mechanized male farmers had a higher GM (USD \$817/ha) than that for the female DB female farmer (USD \$577/ha). Due to With UDP, the GM increased by 39% for the female DB female farmer and 29% for the male IDB male farmers. One of the IDB FSI male farmers used a seeder for rice plantation, while the other used a broadcasting method.

Table 26. Gross Margin and Five Data Points of Dry Paddy for Direct & Indirect Beneficiary Farmers Using the FSI+ Project's Mechanized Applicator Farmers by Gender

	Gender	UP	TP	QS	VS	IC	GM (\$/ha)	% GM Increase (%)
With UDP	DB Female (1)	0.61	3,824.84	3,824.84	598.45	111.35	802.1	39
	IDB Male (2)	28.87	220,188.49	220,188.49	37,625.16	7,234.27	1,052.8	29
	Combined (3)	29.47	224,013.33	224,013.33	38,223.62	7,345.62	1,047.7	31
w/o NUDP	DB Female (1)	2.63	12,742.20	12,742.20	1,993.70	474.00	577.5	
	IDB Male (2)	35.71	233,515.70	233,515.70	39,910.25	10,708.51	817.8	
	Combined (3)	38.34	246,257.90	246,257.90	41,903.95	11,182.51	801.3	
Total	DB Female (1)	3.24	16,567.04	16,567.04	2,592.16	585.35	619.6	
	IDB Male (2)	64.57	453,704.20	453,704.20	77,535.41	17,942.78	922.9	
	Combined (3)	67.81	470,271.24	470,271.24	80,127.57	18,528.13	908.4	

The GM with and without UDP and NUDP was higher in for male DB BMO mechanized male farmers than for male IDB BMO male farmers (Table 27). The GM with UDP was \$733 for male DB BMO mechanized male farmers and \$642/ha for male IDB BMO mechanized male farmers in dry paddy season 2018/19. The GM increased by 57% for male IDB indirect BMO male farmers and 10% for male DB direct beneficiary BMO male farmers when using with UDP.

Table 27. Gross Margin and Five Data Points of Dry Paddy for Direct & Indirect Beneficiary Farmers Using the BMO's Mechanical Applicator Mechanized Farmers

	Gender	UP	TP	QS	VS	IC	GM (\$/ha)	% GM Increase (%)
With UDP	DB Male (2)	0.71	4,545.75	4,495.59	703.40	191.53	733.6	10
	IDB Male (2)	2.75	17,126.00	16,610.42	2,598.94	911.44	642.3	57
	Combined (4)	3.46	21,671.75	21,106.01	3,302.35	1,102.97	661.0	6

W/o NUDP	DB Male (2)	14.68	90,915.00	90,563.88	14,170.04	4,461.38	665.3	
	IDB Male (2)	2.91	15,031.25	14,435.94	2,258.71	1,156.54	410.1	
	Combined (4)	17.59	105,946.25	104,999.82	16,428.76	5,617.92	623.0	
Total	DB Male (2)	15.38	95,460.75	95,059.47	14,873.45	4,652.91	668.4	
	IDB Male (2)	5.67	32,157.25	31,046.36	4,857.66	2,067.97	522.9	
	Combined (4)	21.05	127,618.00	126,105.83	19,731.11	6,720.88	629.2	

Both male DB BMO male and male IDB BMOs males farmers used an HYV variety.

Five Data Points and Gross Margin for Sample Crop Cut Farmers by Planting Method

The majority of direct beneficiary farmers (92% of total DB LB farmers) in the dDelta practiced broadcasting seeds in dry paddy 2018/19. The direct beneficiary DB LB farmers' GM with UDP was higher in with broadcasting seed (BP) (\$644/ha) than with transplanting paddy (TP) (\$374/ha) (**Table 28**). This was due to higher production costs for transplanting and a lower yield compared with broadcasting seed. The percentage of GM increase with UDP was higher for transplanting paddy farmers transplanting paddy (101%) than for seed broadcasting paddy farmers broadcasting seed (50%).

Table 28. Five Data Points and Gross Margin for Direct Beneficiary Farmers by Farm Practice

	Practice	UP	TP	QS	VS	IC	GM	% GM Increase
							(\$/ha)	(%)
W/o NUDP	TP (7)	0.55	2,899.55	2,899.55	408.39	203.99	373.9	101
	BP (73)	5.73	33,658.62	31,989.96	4,987.04	1,555.60	644.4	50
	Combined (80)	6.28	36,558.17	34,889.51	5,395.43	1,759.58	620.5	50
W/o NUDP	TP (7)	17.19	79,073.37	79,073.37	11,510.82	8,318.44	185.7	
	BP (73)	248.77	1,233,049.95	1,186,037.36	184,055.95	84,354.82	430.1	
	Combined (80)	265.95	1,312,123.32	1,265,110.73	195,566.77	92,673.26	414.2	
Total	TP (7)	17.73	81,972.92	81,972.92	11,919.21	8,522.43	191.5	
	BP (73)	254.49	1,266,708.57	1,218,027.32	189,042.99	85,910.42	434.9	
	Combined (80)	272.23	1,348,681.49	1,300,000.24	200,962.20	94,432.85	418.9	

TP = transplanting paddy, BP = broadcasting seed.

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

The majority of direct beneficiary farmers (94%) in the dDelta used a HYV in dry season paddy in 2018/19. The GM with a hybrid variety was the highest when applying UDP (hybrid \$753/ha, HYV \$624/ha, and local \$467/ha) (**Table 29**). The percentage GM increase was 48%, 53%, and 74% for DB LB farmers who used planting HYV, hybrid, and local variety, respectively.

Table 29. Five Data Points and Gross Margin for Direct Beneficiary Farmers by Variety

	Variety	UP	TP	QS	VS	IC	GM (\$/ha)	% GM Increase (%)
With UDP	HYV (75)	5.95	34,776.08	33,379.59	5,172.46	1,670.48	624.7	48
	Hybrid (1)	0.08	561.07	561.07	80.76	19.75	753.5	53
	Local (4)	0.24	1,221.02	948.85	142.20	69.35	467.8	74
	Combined (80)	6.28	36,558.17	34,889.51	5,395.43	1,759.58	620.5	50
W/o NUDP	HYV (75)	247.65	1,233,622.63	1,206,079.54	186,822.39	86,473.45	422.4	
	Hybrid (1)	2.35	14,500.27	14,500.27	2,087.28	927.47	493.9	
	Local (4)	15.95	64,000.42	44,530.92	6,657.11	5,272.35	269.2	
	Combined (80)	265.95	1,312,123.32	1,265,110.73	195,566.77	92,673.26	414.2	
Total	HYV (75)	253.60	1,268,398.71	1,239,459.13	191,994.85	88,143.93	427.1	
	Hybrid (1)	2.43	15,061.34	15,061.34	2,168.04	947.22	502.5	
	Local (4)	16.19	65,221.44	45,479.77	6,799.31	5,341.70	272.2	
	Combined (80)	272.23	1,348,681.49	1,300,000.24	200,962.20	94,432.85	418.9	

Five Data Points and Gross Margin for Sample Crop Cut Farmers by Farm Size

Small-holder DB LB farmers ~~with and without UDP~~ received the highest GM with UDP and NUDP, followed by large- and medium-scale landholder DB LB farmers (~~small~~-\$634/ha, ~~medium~~-\$603/ha, and large-\$622/ha, respectively, with UDP) in the Delta region (Table 30) ~~in the delta region~~. The percentage GM increase was the highest for DB LB large-scale landholder farmers (51%); ~~and it was the same for both DB LB~~ small and medium-scale landholder DB LB farmers had the same percentage GM increase (47%).

Table 30. Five Data Points and Gross Margin for Direct Beneficiary Farmers by Farm Size

	Farm Size	UP	TP	QS	VS	IC	GM (\$/ha)	% GM Increase (%)
With UDP	Small (31)	2.47	14,419.18	13,512.95	2,101.18	675.95	634.1	47
	Medium (29)	2.23	12,936.03	12,454.38	1,897.99	626.88	603.1	47
	Large (20)	1.58	9,202.97	8,922.19	1,396.27	456.76	622.8	51
	Combined (80)	6.28	36,558.17	34,889.51	5,395.43	1,759.58	620.5	50
W/o UDP	Small (31)	43.32	214,233.59	208,902.11	32,113.39	14,258.26	431.1	
	Medium (29)	88.18	443,387.27	423,777.47	64,733.18	31,567.25	410.1	
	Large (20)	134.45	654,502.46	632,431.15	98,720.20	46,847.75	411.4	
	Combined (80)	265.95	1,312,123.32	1,265,110.73	195,566.77	92,673.26	414.2	
Total	Small (31)	45.79	228,652.76	222,415.06	34,214.57	14,934.21	442.0	
	Medium (29)	90.40	456,323.30	436,231.85	66,631.17	32,194.13	414.8	
	Large (20)	136.03	663,705.43	641,353.34	100,116.46	47,304.51	413.8	
	Combined (80)	272.23	1,348,681.49	1,300,000.24	200,962.20	94,432.85	418.9	