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Impact Assessment of the Village Seed Bank (VSB) program for chickpea, groundnut and pigeonpea in the Central Dry Zone of Myanmar, focusing on the production, distribution, productivity and profitability of seed of improved cultivars

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ACIAR-DAR-DoA-ICRISAT collaborative project

Final Report

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Executive summary

A major objective of the Australian Centre for International Agricultural Research (ACIAR)-funded MyPulses project in Myanmar was the development of improved, high-yielding varieties of pigeonpea, groundnut and chickpea through breeding and selection and their widespread adoption by farmers of the Central Dry Zone (CDZ). The village seed bank (VSB) model was implemented by the Department of Agriculture (DoA) with backstopping from MyPulses partner International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in the 2015–16 season, then expanded during 2016–17 and 2017–18. During the three years of the program, a total of 1,343 VSB farmers from 495 villages associated with 104 townships across the CDZ obtained good quality, improved cultivar seeds directly from the DoA. This impact assessment survey was commissioned to examine the extent to which the VSB program was successful in facilitating the spread and adoption of new, improved legume cultivars as well as the productivity and economic benefits of those cultivars. Since it would have been impossible to get feedback about the program from all the VSB farmers, 182 of them from 41 villages were selected at random for the survey.

On average, the surveyed VSB farmers used about 50% of their land for legume cultivation. Their access to information, adequate seed storage facilities and input supplies was generally poor due to the distance from the DoA and Department of Agricultural Research (DAR) support and from seed dealers and markets. The area grown to improved VSB cultivars by the surveyed farmers increased from 154 acres in 2015–16 to 460 acres in 2017–18. Assuming that the surveyed farmers were representative of all the 1,343 VSB farmers who received seed from the DoA, that would be an equivalent of 3,400 acres in 2017–18. Ninety-six percent of the surveyed farmers rated the improved cultivars as either 'satisfactory', 'good' or 'excellent'. Little of the seed produced by the surveyed farmers was sold to seed companies (from <1% for chickpea to 14% for pigeonpea) and 6% (pigeonpea), 27% (chickpea) and 34% (groundnut) was sold to other farmers. On average, seed was sold by the VSB farmers to 3 (groundnut), 8 (pigeonpea) and 10 other farmers (chickpea). We assumed the recipient farmers would in turn sell/give seed to a fewer number of other farmers (2 for groundnut, 4 for pigeonpea or 5 for chickpea). From those figures, we estimated the VSB program's potential informal (farmer-to-farmer) distribution of improved cultivars during 2016–18 to be about 73,000 farmers. This number does not include the 1,343 farmers who originally received the seed from the DoA.

The benefits of the VSB program ranged from access to better quality seed and improved crop and seed production knowledge to increased productivity and profitability. Grain yields from improved VSB cultivars were 34% and 43% higher for sole and intercropped pigeonpea, respectively, 55% higher for groundnut and 52% higher for chickpea. The yield benefits translated into reduced unit (basket) costs and improved net margins by 86,314 Kyats/acre and 84,625 Kyats/acre for sole and intercropped pigeonpea respectively; 177,000 Kyats/acre for groundnut and 264,125 Kyats/acre for chickpea. Lack of seed storage was seen as one of the major issues by most farmers. Nonetheless, 87% of the VSB farmers indicated their willingness to continue in the program.

1. Project background

The MyPulses project (SMCN-2011-047) funded by the Australian Centre for International Agricultural Research (ACIAR), is part of the Australian Government's aid program in Myanmar. The project *Increasing productivity of legume-based farming systems in the Central Dry Zone (CDZ) of Myanmar* aims to improve the livelihoods and food security of smallholder farmers, their families and communities in the CDZ through research on legume-based farming systems that dominate the region. MyPulses is also committed to post-graduate and short-term training of scientists and other personnel from the Department of Agricultural Research, the Department of Agriculture and the Yezin Agricultural University (YAU) and technology transfer to farmers and extension personnel of the DoA and NGOs.

MyPulses is focused on the Nay Pyi Taw Union Territory and the Mandalay, Sagaing and Magway Regions of the CDZ. Farmers in these areas grow more than 2 million hectares of legume crops – chickpea, pigeonpea, groundnut, green gram and black gram – producing about 2.5 million tons of grain annually worth close to US$ 1.1 billion. The potential for area expansion and increased yields of these legumes is considerable.

MyPulses was initiated on 1st July 2013 and originally targeted for completion in June 2017. The project was subsequently granted an extension to June 2018. During the last five years, the project has been implemented successfully with the following specific objectives:

1. Develop new, high-yielding varieties of major crops pigeonpea, groundnut and chickpea and minor crops green gram and black gram through genetic improvement with emphasis on resistance/tolerance to biotic stresses to link with institutional and community-based seed production and distribution.
2. Improve nutrient management of legume-based farming systems, particularly phosphorous (P), nitrogen (N), boron (B), sulfur (S), potassium (K) and Zinc (Zn), using both mineral and organic sources, including rhizobial inoculants.
3. Improve the agronomic management of legume-based systems through crop benchmarking with farmers to increase efficiency of water use and effectively integrate new high-yielding varieties and pest, disease and nutrient management.
4. Enhance RD&E capacity in the relevant agencies in Myanmar through the effective implementation of the collaborative ACIAR project model and through targeted training, extension and capacity building activities.

Under objective 1 of the project, ICRISAT supplied intermediate parental lines together with new sources of germplasm to DAR to develop high-yielding and moderately biotic stress-tolerant cultivars, particularly for chickpea, pigeonpea and groundnut. ICRISAT has been supplying high quality breeding lines to DAR of Myanmar for three decades. However, these efforts became more focused during the last decade with the involvement in two ACIAR-funded projects, SMCN-2006-013 and SMCN-2011-047. The continuous funding since 2007 has strengthened DAR capacity as well as institutionalized effective varietal selection processes. The South Asia region of AVRDC (World Vegetable Centre) represents the new source of germplasm for DAR mung (green gram) and urd bean (black gram) improvement. During the course of both ACIAR projects, the Farmers Participatory Varietal Selection (FPVS) approach was used in the CDZ to identify farmer preferred traits and legume cultivars. During 2014–17, a total of 600 on-station (mother trials) and on-farm (baby trials) trials were conducted across five targeted legume crops and the feedback was collated. As a result, six new improved cultivars are to be released in 2017–18, two each of groundnut, pigeonpea and chickpea.

ICRISAT also worked closely with the DoA in conceptualizing and implementing community/village seed banks for the rapid dissemination of seeds of improved cultivars in the CDZ region. The role of the public sector in legume seed multiplication and distribution is currently negligible, almost absent, in Myanmar. Its efforts are more focused on paddy (rice) and major oilseed crops. Hence, MyPulses aims to fill this gap with pure seed of high-yielding varieties produced and distributed according to the VSB model. This

program, initiated and managed by the DoA, was conceptualized during the first ACIAR-funded project (2007–11) and implemented in the current project during the 2015–18 seasons across three crops, chickpea, pigeonpea and groundnut. About 180 VSBs were initially established during 2015–16, expanded to 516 in 2016–17 and to 647 during 2017–18. Thus, a total of 1,343 VSB farmers directly benefitted from access to pure seed of improved legume cultivars via DoA/DAR.

However, only part of the seed multiplied by these VSBs was returned to the DoA[1], with the remaining either procured by private seed companies, sold in the market or distributed to fellow farmers through informal networks. The multiplied seed brought back to DoA was then redistributed to newly identified VSB farmers either in the same village/township or, more often, new villages/townships. This systematic process has been happening since 2015-16, and all the seed transaction details have been dutifully recorded by DoA support staff in the Township offices. At the same time, a significant quantity of seed generated by VSB farmers was informally redistributed to fellow farmers/friends and relatives in the same village or distant villages. There is no information, however, about these farmer-to-farmer seed transactions, or indeed other informal distribution, in the CDZ. Thus, the present study was commissioned to understand the quantum of both the formal (DoA) and informal (other farmers, seed companies, etc.) distribution of improved VSB varieties in the target areas.

2. Objectives of the study

Against this background, the present study was initiated in July 2017 with the following specific objectives:

- To document and understand the key features of Village Seed Banks
- To quantify the extent of both formal and informal seed production systems and distribution in the VSB program
- To quantify the initial impacts of the improved VSB cultivars on legume productivity and profitability.

3. Seed systems in Myanmar and in the MyPulses project

Seeds are an important input for increasing yields and incomes of Myanmar's farmers. The inherent characteristics of the seed largely determine its production potential and capacity to withstand diseases and shocks like droughts and floods. Therefore, farmers need access to a diversity of good quality seeds of superior cultivars. This enables them to achieve good and secure yields, adapt to climate change, enhance product quality, improve export potential, and, by extension, improve livelihoods and food security.

Traditionally, the legume seed systems in the country fall under 'intermediary public-private sector' type, in which publicly-developed improved cultivars are multiplied by individual seed growers and small-scale national seed companies (the intermediary seed system). This informal and intermediary system largely caters to crops such as rice (open pollinated), oilseeds, pulses and beans, and roots and tubers. The formal seed system includes private companies in which privately-developed cultivars are produced, imported and/or marketed. Vegetable crops and hybrid maize are mainly covered under this seed system.

Many policy directions have been developed in the National Seed Policy of 2016. The overarching policy direction is to "gradually reduce the role of the public sector […] to mainly the provision of services and facilitation". Specifically, in the medium term, the policy sees a catalytic role for public seed research, foundation seed production, the overall seed quality assurance system and seed extension. In particular, the approach of 'seed villages' is being highlighted, where it is envisaged that organized seed growers at

1. As per VSB agreement, for each basket of pure seed obtained from DoA, the VSB farmer has to return 1.5 baskets of multiplied seed in the case of chickpea and pigeonpea and 1.25 baskets in the case of groundnut.

the village level produce certified seeds on a commercial basis. In this respect, the policy aims to support the gradual shift from informal to formal seed production of important food security crops.

The MyPulses project adapted the Village Seed Bank approach for the production and distribution of improved varieties/cultivars of chickpea, pigeonpea and groundnut that had been developed during the course of the project. The extension division of the DoA took the lead in the ground-level implementation and management of the VSBs with technical backstopping provided by ICRISAT. The required quantities of pure/foundation seed of the improved legume varieties/cultivars were provided by DAR. Overall, the main objective of these VSBs was to multiply sufficient quantities of certified/pure seed for wide-scale distribution. The specific objectives of the VSB program are to:

- Obtain sufficient true-to-type pure seed and provide necessary training in production
- Enhance the timely availability of seed
- Reduce reliance on external seed sources
- Enhance productivity by growing pure seed
- Increase improved access to quality seed
- Increase farmers' incomes through sale of good seed
- Prevent the entry of foreign pests and diseases
- Enhance genetic purity through the 'one variety-one village' concept.

4. Formation of the Village Seed Banks (VSBs)

The DoA initiated the VSB program during 2015–16 with activities expanding significantly during the two subsequent cropping seasons, i.e. 2016–17 and 2017–18. Details for each of the three crops, i.e. chickpea, pigeonpea and groundnut, are provided below.

4.1 Pigeonpea

Pigeonpea is highly preferred for cultivation during the monsoon and post-monsoon seasons either as a sole crop or as an intercrop. Table 4.1 summarizes the extent to which individual pigeonpea farmers were involved in the VSB program during 2015–18. Overall, a total of 927 VSB farmers received seed of improved cultivars from the DoA between 2015–16 and 2017–18. Mandalay region farmers received 45% of seed followed by farmers in Sagaing (23%) and Magway regions (22%). Kayah state farmers received the lowest share compared to other areas. The number of VSB farmers receiving seed increased substantially during 2016–17 and 2017–18, compared to 2015–16.

Table 4.2 summarizes the geographical distribution of pigeonpea VSB villages during the study period. The 927 VSB farmers were spread across 274 villages, belonging to 36 townships and four regions/states. The majority of these villages were located in Mandalay region (85) followed by Sagaing (74), Magway (70) and Kayah state (45). The number of pigeonpea VSB villages was 60 during 2015–16, expanding to 140 in 2016–17 and 144 in 2017–18. About 120 VSB villages (44%) received only one improved pigeonpea seed sample during the three years and 228 villages (83%) received ≤5 seed samples. Only 46 villages

Table 4.1 Beneficiary pigeonpea VSB farmers in the CDZ region.

Region/state	2015-16	2016-17	2017-18	Total (%)
Kayah state	0	50	42	92 (10%)
Magway	32	58	111	201 (22%)
Mandalay	60	169	188	417 (45%)
Sagaing	34	84	99	217 (23%)
Grand total	126 (14%)	361 (39%)	440 (47%)	927 (100%)

Dr Robert Edis (ACIAR), Dr Sameer Kumar (ICRISAT) and Dr Tun Shwe (DAR) visit pigeonpea FPVS trials.

Table 4.2 Geographical distribution of pigeonpea VSB villages.

Region/state	Total villages covered	Villages covered in 2015-16	Villages covered in 2016-17	Villages covered in 2017-18
Kayah state	45	0	39	24
Magway	70	11	26	51
Mandalay	85	29	41	37
Sagaing	74	20	34	32
Total	274	60	140[1]	144[1]

[1]Includes villages that had previously received seed samples. Thus, new seed samples were delivered to 274 different villages on 344 occasions.

(17%) received >5 seed samples per village during the 3-year project period. This clearly represented a lack of strategy in seed distribution. The major focus was on geographical coverage rather than varietal penetration/expansion within the targeted villages.

Table 4.3 summarizes the number of times the pigeonpea VSB villages received seed during 2015–18. Two hundred and fourteen (78%) villages obtained improved pigeonpea seed only once during the three cropping years. Fifty villages (18%) received improved seed in two different years and just 10(4%) villages received them in all three years.

Table 4.3 Number of times VSB villages received seed of improved pigeonpea cultivars, 2015-2018.				
Region/state	Once	Twice	Thrice	Total
Kayah state	27	18	0	45
Magway	53	16	1	70
Mandalay	68	12	5	85
Sagaing	66	4	4	74
Total	214	50	10	274

4.2 Chickpea

Chickpea is cultivated during the post-monsoon season, usually following rice and reliant on residual soil moisture. It is essentially grown as a sole crop and not intercropped. Table 4.4 summarizes the extent to which individual chickpea farmers were involved in the VSB program during 2015–18. Overall, a total of 269 farmers received improved cultivar seed from the DoA between 2015-16 and 2017–18. Mandalay region farmers received 48% of seed followed by farmers in Magway (35%), Sagaing (14%) and Nay Pyi Taw state (3%). The number of VSB farmers receiving seed increased significantly during 2016–17 and 2017–18, compared with 2015–16.

Table 4.5 summarizes the geographical distribution of chickpea VSB villages during the study period. The 269 VSB farmers were spread across 129 villages, belonging to 36 townships and 4 provinces. The majority of these villages were located in Mandalay (59) followed by Magway (52), Sagaing (17) and Nay Pyi Taw .

The number of chickpea VSB villages was 32 during 2015–16, expanding to 68 in 2016–17 and 73 in 2017–18. Seventy-six VSB villages (59%) received only one improved chickpea seed sample during the three-year project period, 121 villages (94%) received ≤5 seed samples, and 8 villages (6%) received >5 seed samples per village.

The survey and farmer responses revealed that there were specific preferences for *desi* and *kabuli* type chickpea among targeted villages. However, there appeared to be a few incidences of mismatch in the distribution of the correct chickpea type. A proper planning and seed distribution strategy, accounting for these preferences, would have further expanded the spread of improved chickpea cultivars in the CDZ.

Table 4.4 Beneficiary chickpea VSB farmers in the CDZ region.				
Region/state	2015-16	2016-17	2017-18	Total (%)
Magway	13	39	42	94 (35%)
Mandalay	23	49	57	129 (48%)
Nay Pi Taw	0	4	4	8 (3%)
Sagaing	4	14	20	38 (14%)
Total	40 (15%)	106 (39%)	123 (46%)	269 (100%)

Table 4.5 Geographical distribution of chickpea VSB villages.				
Region/state	Total villages covered	Villages covered in 2015–16	Villages covered in 2016–17	Villages covered in 2017–18
Magway	52	9	24	33
Mandalay	59	19	33	31
Nay Pi Taw	1	0	1	1
Sagaing	17	4	10	8
Total	129	32	68[1]	73[1]

[1]Includes villages that had received seed samples in 2015-16.

Farmers actively participate in Farmer's Participatory Varietal Selection (FPVS) chickpea trials.

A bumper harvest of MyPulses improved chickpea cultivars in Myanmar.

Dr Pooran Gaur (ICRISAT) monitors chickpea FPVS trials in Myanmar.

Table 4.6 summarizes the details of repetition of chickpea VSB villages during 2015–18. Ninety-five (74%) of VSB villages obtained seed of improved chickpea variety only once during the three cropping years. Twenty-seven villages (21%) received them in two different years and just seven villages (5%) received them in all three years.

Table 4.6 Number of times VSB villages received seed of improved chickpea cultivars.

Region/state	Once	Twice	Thrice	Total
Magway	41	8	3	52
Mandalay	41	15	3	59
Nay Pi Taw	0	1	0	1
Sagaing	13	3	1	17
Total	95	27	7	129

4.3 Groundnut

Groundnut is cultivated in both monsoon and post-monsoon seasons. Occasionally, it is also grown in the summer season where irrigation is assured. Table 4.7 summarizes the extent to which individual groundnut farmers were involved in the VSB program during 2015–18. Overall, a total of 147 farmers received seed of improved groundnut cultivars from the DoA between 2015-16 and 2017-18. Mandalay farmers received 54% of seed followed by farmers in Shan (19%), Bago (11%), Sagaing (10%), Magway (5%) and Nay Pi Taw (1%). The number of VSB farmers receiving seed increased significantly during 2016–17 and 2017–18, compared with 2015-16. It should be noted that the initial number of groundnut farmers involved in the program during 2015–16 was just 14. This would have been at least partly due to the large size of the groundnut seeds and the large volumes required for planting. Momentum was generated, however, and 84 farmers were involved in the program during the 2017–18.

Table 4.8 summarizes the geographical distribution of groundnut VSB villages during the study period. The 147 VSB farmers were spread across 92 villages, belonging to 32 townships and 6 provinces. The

Dr Hari Upadhyaya (ICRISAT) and DAR scientists inspect groundnut FPVS trials in Myanmar.

Table 4.7 Beneficiary groundnut VSB farmers in the CDZ region.

Region/state	2015–16	2016–17	2017–18	Total (%)
Bago	0	4	12	16 (11%)
Magway	1	3	4	8 (5%)
Mandalay	10	27	42	79 (54%)
Nay Pi Taw	0	1	1	2 (1%)
Sagaing	3	4	7	14 (10%)
Shan	0	10	18	28 (19%)
Total	14 (10%)	49 (33%)	84 (57%)	147 (100%)

Table 4.8 Geographical distribution of groundnut VSB villages.

Region/state	Total villages covered	Villages covered in 2015-16	Villages covered in 2016-17	Villages covered in 2017-18
Bago	10	0	2	8
Magway	8	1	3	4
Mandalay	49	10	25	24
Nay Pi Taw	1	0	1	1
Sagaing	10	3	4	4
Shan	14	0	6	9
Total	92	14	41[1]	50[1]

[1]Includes villages that had received seed samples in 2015-16.

majority of these villages were located in Mandalay (49) followed by Shan (14), Sagaing (10), Bago (10), Magway (8) and Nay Pyi Taw (1). The number of groundnut VSB villages was 14 during 2015–16, expanding to 41 in 2016–17 and 50 in 2017–18. Sixty-four VSB villages (70%) received only one improved chickpea seed sample during the three-year period with 88 villages (96%) receiving ≤5 seed samples. Only four villages (4%) received >5 seed samples per village during the 3-year project period. These results highlight the limitations of the VSB program in disseminating improved groundnut cultivars in the MyPulses target area. The lack of an effective strategy in groundnut seed distribution, low rates of seed multiplication, poor storage facilities and viability of seed further aggravated the limited spread of cultivars.

Table 4.9 Number of times VSB villages received seed of improved groundnut cultivars.

Region/state	Once	Twice	Total
Bago	10	0	10
Magway	8	0	8
Mandalay	39	10	49
Nay Pi Taw	0	1	1
Sagaing	9	1	10
Shan	13	1	14
Total	79	13	92

Table 4.9 summarizes the details of groundnut seed received in VSB villages during 2015–18. Seventy nine VSB villages (86%) obtained improved groundnut seed only once during the three cropping years. Thirteen villages (14%) received improved seed in two different years and no village received improved seed in all three years.

5. Sampling and methodology of the VSB impact assessment survey

Details of the sampling and methodology used in data collection and analysis of this impact assessment study are summarized in this section.

5.1 Sampling and coverage

The number of farmers involved in the VSB program, as well as the number of villages, townships and regions to which they belonged are summarized in Table 5.1. A total of 1,343 farmers received seed of improved cultivars of pigeonpea, chickpea and groundnut from the DoA between 2015-16 and 2017-18. These farmers resided in 495 villages associated with 104 townships. It would have been a herculean task to survey all 1,343 VSB farmers. Due to limitations of time and budget, this impact assessment study aimed to cover at least 10% of the VSB villages. Accordingly, a random sampling method was applied using the 'probability to proportion' approach. The total number of VSB farmers per village was used as a determining factor for randomization among VSB villages. This approach considers the variability in seed distribution across the time period (i.e. 2015–16 to 2017–18) for a given village. A survey questionnaire (Annexure 1) was developed and the survey conducted during 5–18 December 2017. The information collected during the survey relates to the 2017–18 cropping year.

Using this approach, targeted sampling for each of the three crops was designed, as shown in Tables 5.2–5.4. Thirty pigeonpea VSB villages were randomly selected out of 274 (Table 5.2) and a total of 278 farmers were targeted for the survey in those villages. However, the actual survey sample was only 135

Table 5.1 Total number of VSB farmers and their geographical coverage.

Crop	No. of VSB farmers[1]	Total		
		Villages	Townships covered	Region/state
Pigeonpea	927	274	36	4
Chickpea	269	129	36	4
Groundnut	147	92	32	6
Total	1343	495	104	14

[1]Includes 2015-16, 2016-17 and 2017-18 cropping seasons.

Table 5.2 Pigeonpea VSB farmers covered in the survey.

Region/state	Township	Village	Sample targeted	Actual sample covered
Kayah state	Ba La Khae	Chokowe	3	0
Magway	Yaysakyoe	Myoutkalan	23	0
Magway	Myaing	Oying	13	11
Magway	Yaysakyoe	Sithar	7	10
Magway	Salin	Nyaungpin	6	6
Magway	Myaing	Tanatyin	4	0
Magway	Pwint Phyu	Kyit King	2	2
Magway	Salin	Tamarcoung	1	0
Mandalay	Thar Si	Kyotkokan	31	0
Mandalay	Myin Gyan	NGO[1]	31	16
Mandalay	Kyauk Pandaung	Sintaingkan	27	12
Mandalay	Ma Hlaing	Laetaw	15	15
Mandalay	Pyaw Bwe	Phaungtaw	15	4
Mandalay	Taung Thar	Tamitethar	13	4
Mandalay	Kyauk Pandaung	Popa	8	8
Mandalay	Ma Hlaing	Thetkalkyin	6	6
Mandalay	Ye Mae Thin	Lapantaw	6	3
Mandalay	Ma Hlaing	Nyaungoake	4	4
Mandalay	Ma Hlaing	Kangyi	3	3
Mandalay	Ye Mae Thin	Bout	2	1
Mandalay	Ye Mae Thin	Myinnar	1	0
Sagaing	De Pe Yin	Satpyarkyin	16	4
Sagaing	Sagaing	Bouttound	11	7
Sagaing	Yin Mar Pin	Pa Thae Gone	10	9
Sagaing	Sagaing	Tharzin	8	0
Sagaing	Ka Ni	Wayar	5	4
Sagaing	Myin Mu	Hteesoung	3	3
Sagaing	Chaung Oo	Myotthit	2	1
Sagaing	Sagaing	Latpan	1	1
Sagaing	Palae	Nweshoung	1	1
Total			278	135

[1]Improved seed provided to an NGO in the township.

farmers (49% of the target). Similarly, 13 chickpea VSB villages were randomly selected from the total population of 129 villages (Table 5.3). Twenty-three (59%) chickpea farmers were interviewed out of the target sample of 39 farmers. In the case of groundnut, 10 villages were randomly selected for the survey from the original 92 villages (Table 5.4). Of the target sample of 28 farmers, 24 (86%) were surveyed.

Overall, the impact assessment survey across the three crops targeted 345 VSB farmers from 53 villages. The actual survey involved 182 VSB farmers across three crops, representing 53% of the targeted sample. The reasons for the lower coverage of targeted pigeonpea VSB farmers in the survey (49%) included the larger geographical spread of the villages, the high number of farmers per village, the random selection of outlying (remote) villages and the limited time available to conduct the survey. In the case of groundnut, the limited spread of VSB villages and low number of farmers per village contributed to greater coverage of targeted groundnut farmers. Chickpea occupied the middle ground in terms of coverage. Some of the

Table 5.3 Chickpea VSB farmers covered in the survey.

Region/state	Township	Village	Sample targeted	Actual sample covered
Magway	Yae Sa Gyo	Myae Taw	10	4
Magway	Myaing	Taungzone	3	2
Magway	Pauk	Htantapin	1	0
Mandalay	Ye Mae Thin	Thanegome	6	3
Mandalay	Pyaw Bwe	Phayargyi	3	3
Mandalay	Mya Nadi Seed Farm	Seed farm[1]	2	0
Mandalay	Kyaukpadaung	Kaing	2	0
Mandalay	Pathein Gyi	Nyeinchantharsan	1	1
Mandalay	Meik Hti Lar	Quartngae	1	1
Sagaing	Shwebo	Koe Pin	2	1
Sagaing	Chaung Oo	MagyiKha	3	3
Mandalay	Myingyan	Htnaungkoung	3	3
Mandalay	Kyauk pandaung	Kaing	2	2
Total			39	23

[1]Seed provided to a research station.

Table 5.4 Groundnut VSB farmers covered in the survey.

Region/state	Township	Village	Sample targeted	Actual sample covered
Bago	Pauk Khone	Ban Pyin	3	3
Bago	Thaekone	Byama Inn	2	2
Bago	Shwe Taung	Thayet Tone Pin	1	1
Magway	Kone Thar (Yae Sa Kyoe)	Pauk Ku	1	0
Mandalay	Ya Me Thin	Kan Ma	7	6
Mandalay	Nyaun Oo	Nat Palin	6	6
Mandalay	Meik Hti Lar	Igyii Lae	4	4
Mandalay	NGO (Myingyan)	That Ywar	2	1
Mandalay	Taung Thar	Kwan Gyan	1	0
Mandalay	Nga Tho Gyi	Ywar Tar Aye	1	1
Total			28	24

more general reasons for reduced coverage of targeted farmers included the nonavailability of farmers during the survey team's visit and remoteness of some villages.

5.2 Methodology

To better capture the impact assessment objectives and perceptions of the farmers, the survey was constructed using a well-tailored research design. Both quantitative and qualitative research methods were used to cover the key research issues, such as the volume of formal or direct (DoA-VSB farmer-DoA) and informal or indirect (VSB farmer-other farmer) spread of improved cultivar seed, technology dissemination and impacts on productivity enhancement, etc. Quantitative methods included analysis of data collected from both primary and secondary sources. Primary data was collected through the formal survey (Annexure 1) from randomly-selected VSB sample farmers. Perceptions about the performance of improved cultivars and feedback on seed production training programs, etc., were elicited qualitatively.

Data collation and analysis was done using quantitative techniques and qualitative methods. Attempts were also made to integrate the information collected. Overall, the following step-by-step approach and methods were used for generating this report.

- A series of interactions with the DoA and DAR paved the way for documenting the formal seed distribution process over time (2015-18) and designing the sampling framework suitable for the study. The villages to be surveyed were randomly selected to reflect the current status of seed interventions across selected crops.
- The list of VSB farmers, available from township managers, was used as the basis to select the farmers.
- Approximately 10% of the villages for each crop were targeted because of time and budget constraints. A total of 182 farmers were eventually interviewed across the three crops.
- The surveyed farmers were invited to township offices for personal interviews to cut down on travel time. On a few occasions, the interviews were conducted in the VSB villages.
- Primary data was collected from VSB farmers using a well-structured and pre-tested survey questionnaire (Annexure 1). The reference cropping year for primary data collection was 2017–18.
- The present study used simple tabular analysis with appropriate measure of central tendencies for summarizing the scoping survey responses. Both quantitative and qualitative responses were used for summarizing the results by providing appropriate weights/scales as needed.
- Recommendations and the way forward are based on the analysis and interpretation of the results, with additional inputs from DoA/DAR/township managers.

5.3 Limitations of the study

The results and findings generated from this study are based on representative randomly-selected VSB farmers in the CDZ. The findings can only be scaled-up to the targeted villages and regions. They may be suitably modified when applied to the entire CDZ region. Time was a major factor that limited the scope of the survey and interactions with various other stakeholders in the townships/regions. The reflections

DoA staff collect survey data on Impact of Village Seed Bank (VSB).

DoA staff collect survey data on the impact of Village Seed Banks.

of other major stakeholders such as DAR, private seed companies and NGOs were incorporated into the existing report. There was unusually dry weather in some townships and information gathered on productivity during a normal year could be different from that collected during the survey period (2017–18).

6. Key findings

This section summarizes the key findings from the VSB farmer survey and provides an analysis. Sub-sections highlight crop-wise details.

6.1 Characteristics of village seed bank farmers

Socio-economic information on the surveyed VSB farmers and households are shown in Table 6.1. A majority (59%) of the farmers were over 50 years old and just 3% were less than 30 years old. Most of the farmers (91%) had low (<10 years) formal education. The average family size across the 182 surveyed farmers was close to 5.0. Average family size was slightly higher in the case of groundnut farmers (6), followed by pigeonpea (5.5) and chickpea (4.9). Family member's participation in agricultural activities was highest (60%) for chickpea farmers. Participation rates were 50% and 46% for pigeonpea and groundnut farmers, respectively.

Table 6.2 summarizes details of landholdings of the surveyed VSB farmers. In the case of chickpea, 26% of the farmers owned <5 acres. Most of the farmers (44%) owned medium sized farms of 5–10 acres and 30% of them owned >10 acres. The average farm size of chickpea farmers was 14.1 acres and was the highest among the three crops. Just over half (53%) of the land of the surveyed farmers was rainfed, the remaining 47% being irrigated.

In the case of pigeonpea, 25% of the farmers owned <5 acres and 33% owned 5–10 acres. Most (42%) of the farmers owned >10 acres. The average farm size of pigeonpea farmers was 13.9 acres, of which 98% was rainfed. For groundnut, 21% of surveyed VSB farmers owned <5 acres, 38% owned 5–10 acres, and

Table 6.1 Demographics of surveyed VSB farmers.

VSB farmer type	Age of family head		Formal education completed		Family size[1] (no. of members)	
	Years	No. of farmers	Years	No. of farmers	Persons	No. of farmers
Chickpea (N=23)	<30	1	0–5	13	<3	3
	31–40	5	6–10	8	3–5	14
	41–50	5	>10	2	>5	6
	51–60	6				
	>60	6				
Pigeonpea (N=135)	<30	3	0–5	76	<3	16
	31–40	17	6–10	48	3–5	51
	41–50	35	>10	11	>5	68
	51–60	45				
	>60	35				
Groundnut (N=24)	<30	1	0–5	4	<3	2
	31–40	3	6–10	17	3 to 5	9
	41–50	5	>10	3	> 5	13
	51–60	6				
	>60	9				

[1]including children.

Table 6.2 Details of landholdings of surveyed VSB farmers.

VSB farmer type	Landholding size (acres)	No. of farmers	Average farm size (acres)	Average rainfed area (acres)	Average irrigated area (acres)
Chickpea (N=23)	Small (<5)	6			
	Medium (5–10)	10			
	Large (> 10)	7	14.1	7.5	6.6
Pigeonpea (N=135)	Small (<5)	33			
	Medium (5–10)	45			
	Large (> 10)	57	13.9	13.7	0.2
Groundnut (N=24)	Small (<5)	5			
	Medium (5–10)	9			
	Large (> 10)	10	12.6	12.6	0

most (41%) owned >10 acres. The average farm size of groundnut farmers was 12.6 acres, 100% of which was rainfed.

Table 6.3 summarizes the area cultivated to different legumes by the 182 surveyed farmers. On average, the chickpea farmers used 8.4 acres (58%) of their total landholding of 14.1 acres for legume cultivation. Most of the chickpea farmers cultivated green gram (2.0 acres) during the monsoon season followed by pigeonpea (0.6 acres) and groundnut (0.5 acres). Chickpea dominated cropping during the winter season with an average of 5.3 acres. Yezin-4 and Yezin-6 were the preferred chickpea cultivars grown. Farmer's own saved seed was the major seed source for chickpea and the other legumes.

On average, pigeonpea VSB farmers used 6.9 acres (50%) of their total landholding of 13.9 acres to grow legumes. Pigeonpea was the single dominant crop during the monsoon season. Groundnut and chickpea were the preferred winter season crops. Monywa Shwe Din Gar (MSDG) and local landraces were the most preferred cultivars. Own saved seed and the DoA were the major sources of seed for pigeonpea and other legumes.

Table 6.3 Area cultivated to legumes by the surveyed VSB farmers (acres per household).

VSB farmer type	Legume cultivated	Area (acres)	Season	Preferred cultivars	Sources of seed
Chickpea (N=23)	Pigeonpea	0.6	Monsoon	MSDG/local	Own seed/DoA
	Chickpea	5.3	Winter	Yezin-4/6	DoA/own seed
	Groundnut	0.5	M/W	Yezin-7/SP 121	DoA/ own seed
	Black gram	0.0	NA	NA	NA
	Green gram	2.0	Monsoon	Yezin-11/14	DoA/ own seed
Pigeonpea (N=135)	Pigeonpea	4.9	Monsoon	MSDG/local	DoA/ own seed
	Chickpea	0.6	Winter	Yezin-6/local	DoA/ own seed
	Groundnut	1.0	M/W/S	Sinpaditha-11/local	DoA/ own seed
	Black gram	0.1	Aug/May	Yezin-2/local	DoA/ own seed
	Green gram	0.3	Monsoon	Yezin-11/14	DoA/ own seed
Groundnut (N=24)	Pigeonpea	1.3	Monsoon	MSDG/local	DoA/ own seed
	Chickpea	0.3	Winter	Yezin-3/local	DoA/ own seed
	Groundnut	2.4	M/W	Sinpaditha-11/local	DoA/ own seed
	Black gram	0.5	Winter	Yezin-3/local	DoA
	Green gram	1.0	Monsoon	Yezin-11/14	DoA

MSDG: Monywa Shwe Din Gar; M/W/S: Monsoon/Winter/Summer.

Table 6.4 Access to sources of information, inputs and markets.

VSB farmer type	Access source	Distance (kms)
Chickpea	Research station/information centre	13
(N=23)	Seed dealer/seed shop	16
	Regulated market	16
	Distance to storage facility	NA
Pigeonpea	Research station/information centre	16
(N=135)	Seed dealer/seed shop	19
	Regulated market	19
	Distance to storage facility	NA
Groundnut	Research station/information centre	14
(N=24)	Seed dealer/seed shop	NA
	Regulated market	NA
	Distance to storage facility	NA

On average, groundnut farmers used 5.4 acres (43%) of their total landholding of 12.6 acres for legume cultivation. Groundnut was the single dominant legume during both monsoon and winter seasons. The other monsoon season legumes were pigeonpea and green gram. Sinpaditha-11, SP 121, Yezin-7 and other local types were preferred cultivars. Own saved seed and DoA were the major sources of seed for groundnut and other legumes.

Details on access to major sources of information, inputs and markets by the surveyed VSB farmers are presented in Table 6.4. In general, access to DAR and DoA research stations and information centres was poor. The research stations were, on average, located 13–16 kms from the VSB farmers. Access to seed dealers/seed shops was also poor. As discussed in the previous sections, public sector seed multiplication, i.e. by the DoA and DAR, is focused more on paddy and oilseed crops. Private sector seed companies primarily focus on high-value vegetable crops and maize hybrids. As a result, the majority of pulse and oilseed legume growers depend on their own saved seed or seed from the DoA. Even the villages that were close to seed dealers/shops had limited access to improved legume cultivars because they were not available in those outlets. Public sector regulated markets are almost absent in the country. Good quality storage facilities are almost absent or are not accessible to legume growers. Thus, in the majority of cases, legume growers are forced to sell their produce in their home/other villages to middlemen or processors.

Seed storage methods and various issues faced by the surveyed VSB farmers are detailed in Table 6.5. The most common method of seed storage was in bags or baskets, but there was a general absence of good quality on-farm storage facilities. Pest infestation and moisture loss were common among majority of farmers. Damage by rats and declining seed viability were additional issues for groundnut farmers.

Details about seed replacement rates (SRR) for chickpea, pigeonpea and groundnut are summarized in Table 6.6. In the case of chickpea, only 17% of the farmers replaced seed every year and 44% of them replaced seed every second year. The other 39% replaced seed every three years or less often. The major source of seed for seed replacement was either the DoA/DAR/township offices or neighboring farmers. It was a little different for the pigeonpea VSB farmers, with the highest proportion (48%) replacing seed only every third year. The major source of new pigeonpea seed was the DoA/DAR directly or the DoA township offices. Seed purity and quality were major issues. Some 46% of groundnut VSB farmers indicated that they replaced seed only once every three years. DAR/DoA and township offices were identified as major sources of new groundnut improved seed. Poor germination and moisture loss were the common problems faced.

Table 6.5 Legume seed storage methods and storage issues.

VSB farmer type	Storage methods	Issues in seed storage
Chickpea (N=23)	Bags	Bruchid beetle damage Moisture loss Lack of on-farm storage space
Pigeonpea (N=135)	Bags, baskets and tins	Pest infestation Moisture loss Lack of storage space
Groundnut (N=24)	Bags, baskets and tins	Damage by rats Moisture loss Declining seed viability

Table 6.6 Pulse seed replacement rates.

VSB farmer type	How often seeds are replaced	Farmer (%)	Major sources of seed	Farmer (%)	Remarks
Chickpea (N=23)	Every year	17%	Purchased	12%	Reasonable quality chickpea seeds available
	Once in two years	44%	Borrowed	28%	
	Once in three years	13%	DAR/DoA/Township offices	46%	
	Never	0%			
	Not planned	26%	Others	14%	
Pigeonpea (N=135)	Every year	19 %	Purchased	3%	Poor quality Low purity
	Once in two years	17%	Borrowed	14%	
	Once in three years	48%	DAR/DoA/ Township offices	70%	
	Never	14%			
	Not planned	2%	Others	13%	
Groundnut (n=24)	Every year	4%	Purchased	4%	Low purity Poor germination Moisture loss
	Once in two years	38%	Borrowed	13%	
	Once in three years	46%	DAR/DoA/ Township offices	71%	
	Never	8%			
	Not planned	4%	Others	12%	

6.2 Spread of improved cultivars

The rapid spread of new improved pulse cultivars was one of the objectives of the MyPulses project. The extent of area over which improved cultivars spread during 2015–17 is examined in the following sub-sections. Awareness of VSBs by surveyed farmers across the three crops is summarized in Table 6.7. Predictably, all the sample farmers were aware of the VSB scheme introduced by DoA in the targeted townships/villages. Also, awareness increased over time i.e., from 2014 to 2017, as more farmers joined the scheme.

Details about cultivars and the supply of their seeds are presented in Table 6.8. On average, a chickpea farmer received 2.2 baskets of seed of Yezin-12, Yezin-4 and Yezin-6 in the targeted villages. In the case of pigeonpea, the average quantity of improved cultivar seed distributed was 7.5 pyi (approximately 0.5 baskets). Monywa Shwe Din Gar (MSDG) was the only pigeonpea cultivar supplied in the program. The farmers were happy with this cultivar because they believed it had more branches and pods than other local types. The seed coat color was preferred by both processors and millers. However, it failed to perform well under heavy rainfall conditions due to poor seed set. VSB groundnut farmers, on average, received 7.0 baskets of improved seed in the targeted villages. Sinpaditha-11 was the most dominant cultivar distributed. The majority of VSB farmers appeared to have good awareness of the VSB improved cultivars.

Table 6.7 Farmer awareness about village seed banks.

VSB farmer type	Awareness about VSBs	Farmers (no.)	When farmers first heard about it	Farmers (no.)
Chickpea	Yes	23	2014	0
(N=23)	No	0	2015	4
			2016	19
			2017	0
Pigeonpea	Yes	135	2014	2
(N=135)	No	0	2015	38
			2016	40
			2017	55
Groundnut	Yes	24	2014	1
(N=24)	No	0	2015	5
			2016	8
			2017	10

Table 6.8 Details of cultivars and quantities of seed provided to VSB farmers.

VSB farmer type	Year first seed obtained	Average quantity obtained	Name of cultivars
Chickpea	2015–16	1.5 baskets	Yezin-12
(N=23)	2016–17	0.4 basket	Yezin-4
	2017–18	NA	Yezin-6
Pigeonpea	2015–16	7 pyi	Monywa Shwe Din Gar
(N=135)	2016–17	7 pyi	Monywa Shwe Din Gar
	2017–18	5 pyi	Monywa Shwe Din Gar
Groundnut	2015–16	NA	NA
(N=24)	2016–17	5.2 baskets	Sinpaditha-11
	2017–18	6.4 baskets	Sinpaditha-11

Note: One pigeonpea basket = 16 Pyi.

6.3 Area grown to improved cultivars (2015–16 to 2017–18)

The area grown to improved cultivars by the surveyed VSB farmers during the three years, 2015–16, 2016–17 and 2017–18 are shown in Figures 6.1 (pigeonpea), 6.2 (groundnut) and 6.3 (chickpea). For pigeonpea, area increased each year. By 2017–18, the surveyed farmers were growing 383 acres of improved cultivars, equal to an average 2.8 acres/farmer, representing close to 60% of their total pigeonpea plantings.

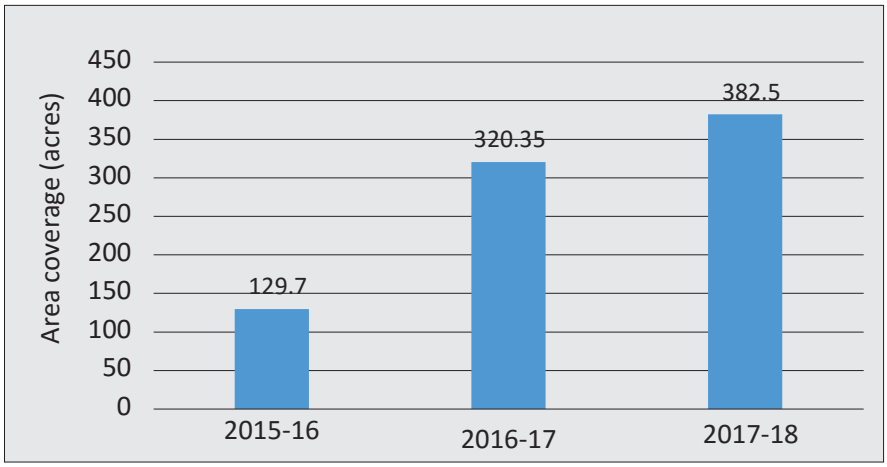

Figure 6.1 Expansion in area planted to improved pigeonpea cultivars by VSB farmers.

Previously, all the surveyed farmers mainly grew local landraces such as Maeyine local, Shwe Ta Sout, Tonaya, Taphathlae (red), etc. Their major sources were farmer's own saved seed (46%), seed borrowed from fellow farmers (45%), purchased from local markets (6%) and others (3%).

Figure 6.2 shows the area expansion of improved groundnut cultivars. The area of spread was low compared with the other two crops, the possible reasons for which were discussed in Section 4.3 of this report. By 2017–18, the surveyed farmers were growing 27 acres of improved cultivars, equal to an average 1.1 acres/farmer, representing 47% of their total groundnut plantings. Previously, all the surveyed farmers grew local/old improved cultivars such as SB 121, Japan Gyi, Spain variety and SP-121, etc. The sources of seed for previous cultivars were 58% own saved seed and 25% borrowed from fellow farmers. The remaining 17% of farmers purchased seed from the local market.

Figure 6.3 shows the area expansion of improved chickpea cultivars by surveyed VSB farmers. By 2017–18, the 23 surveyed farmers were growing 51 acres of improved cultivars, equal to an average 2.2 acres/farmer, representing 41% of their total chickpea plantings. Previously, all the surveyed farmers grew old local cultivars (karachi type) as well as old improved cultivars such as ICCV 2/Yezin-3, Yezin-4 and Yezin-6. The sources of seed for previous cultivars were 65% purchased seed from local markets and 13% borrowed seed from fellow farmers. The rest of the farmers depended on their own saved seed and that provided by DoA/DAR/township managers.

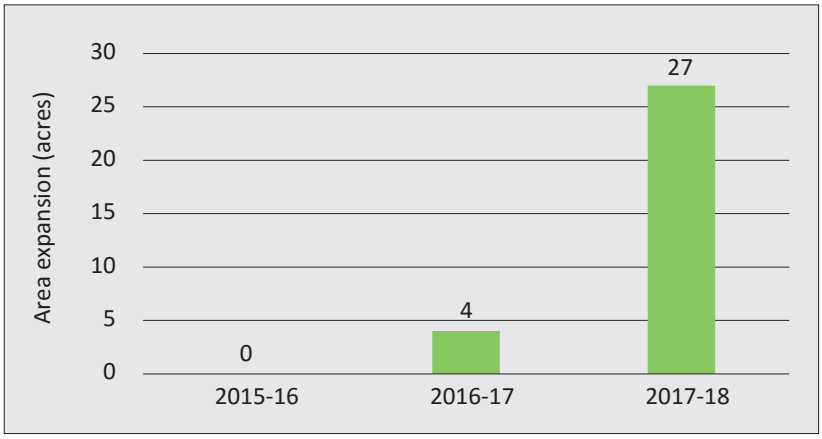

Figure 6.2 Expansion in area planted to improved groundnut cultivars by VSB farmers.

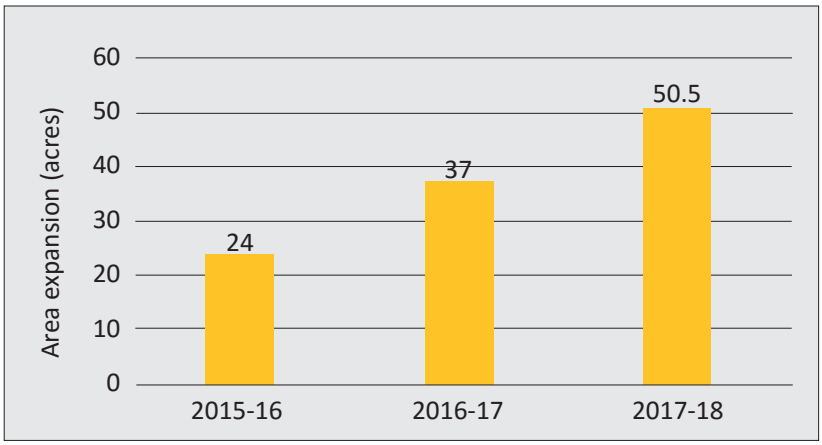

Figure 6.3 Expansion in area planted to improved chickpea cultivars by VSB farmers.

Table 6.9 Coverage of improved cultivars in surveyed VSB farms.

VSB farmer type	Range of coverage of own farm with improved cultivars	Coverage (%)
Chickpea (N=23)	1–25	4
	26–50	35
	51–75	9
	76–100	52
Pigeonpea (N=135)	1–25	40
	26–50	31
	51–75	14
	76–100	15
Groundnut (N=24)	1–25	50
	26–50	42
	51–75	4
	76–100	4

Table 6.10 VSB farmers' perceptions about improved cultivars.

VSB farmer type	Perceptions compared to old cultivars	Farmers (%)	Reasons for poor performance	Reasons for limited expansion
Chickpea (N=23)	Bad Satisfactory Good Excellent	4 57 30 9	- Wilt disease - High pest attack	NA
Pigeonpea (N=135)	Bad Satisfactory Good Excellent	2 13 69 16	- Climate has significant influence on yield High pest attack	- High pest attack - Drought/insufficient rains reduce yield
Groundnut (N=24)	Bad Satisfactory Good Excellent	4 34 50 12	- Poor seed quality - Poor germination	- Not enough seed - Low multiplication ratio - No storage facilities

The coverage of improved cultivars in the surveyed VSB farms is shown in Table 6.9. There was good penetration of improved chickpea cultivars. More than half (52%) of the chickpea farmers used improved cultivars almost exclusively, with a further 35% using improved cultivars for 26–50% of their chickpea plantings. A reasonable 29% of pigeonpea farmers and 8% of groundnut farmers used improved cultivars on more than half of their plantings. Clearly, more effort is needed to facilitate the spread of improved groundnut cultivars in the region.

Farmer perceptions about the improved cultivars are summarized in Table 6.10. Almost all (96%) surveyed farmers rated the improved cultivars as either 'satisfactory', 'good' or 'excellent'. The rating of 'bad' by 4% of the farmers may have reflected problems caused by extreme weather conditions, severe pest infestation or poor seed germination. Fusarium wilt was the major problem noted by the surveyed chickpea farmers. Drought and insufficient rains were major limitations in the case of pigeonpea. Lack of availability of seed was the major concern for groundnut.

6.4 Status of improved variety seed produced

It is important to know how much of the seed of improved varieties produced in the VSBs is sold/distributed to other farmers in the village or farmers in different villages (Table 6.11). For chickpea, the average production of seed per farmer was 41 baskets, of which 27% was sold to other farmers, 11% given back to the DoA to be distributed to new VSB farmers, 8% kept by the farmer as seed for further use, with the remaining 54% used in a variety of ways (in-kind wages, sold to private seed companies,

Table 6.11 Status of seed of improved cultivars produced by VSB farmers during 2017-18.

VSB farmer type	Average output (baskets)	Consumed[1]	Kept as seed	Given back to DoA	Sold as seed	Sold to private companies	Other uses
Chickpea (N=23)	40.8	0.5	3.2	4.5	11.2	0.2	21.3
Pigeonpea (N=135)	21.7	0	0.5	0.6	1.3	3.1	16.4
Groundnut (N=24)	50.2	1.0	12.0	8.0	17.0	0.2	12.0

[1]Includes payment of in-kind wages.

sold in the market as chickpea grain, etc.). The amount sold to private seed companies was negligible (<1%), reflecting an underdeveloped pulse seed sector in Myanmar. The fact that more than half the improved chickpea seed produced in the VSBs may have been sold as grain is a problem and suggests that substantially more education and training are needed to reinforce the potential value of this seed to the VSB farmers and beyond. Ideally, most of the VSB-produced seed should be sold either to other farmers or to seed companies. The next largest consumer of the seed should arguably be the DoA in a buy-back scheme so that they have sufficient supplies to expand the scheme.

The situation may have been even more disappointing with pigeonpea. The average production of seed per farmer was 22 baskets, of which just 6% was sold to other farmers, 3% given back to the DoA to be distributed to new VSB farmers, 2% kept by the farmer as seed for further use, 14% sold to private seed companies and the remaining 75% used in a variety of ways, but most likely sold in the market as pigeonpea grain. The fact that three quarters of the VSB-produced seed may have been sold as grain could have been a reflection of the current poor market conditions for pulse and oilseed legumes including pigeonpea in Myanmar. These market conditions in turn reflect the downturn in the Indian export market. Farmers naturally react to lowered prices by growing something else, if they are able, thereby reducing demand for seed.

For groundnut, the average production of seed per farmer was 50 baskets, of which 34% was sold to other farmers, 16% given back to the DoA to be distributed to new VSB farmers, 24% kept by the VSB farmer as seed for further use, 1% sold to private seed companies and the remaining 24% most likely sold in the market.

6.5 Informal distribution of VSB-produced seed

Details on the distribution of VSB-produced seed to other farmers is summarized in Table 6.12. Each chickpea farmer informally sold/distributed improved cultivar seed to an average of 10 fellow farmers. The majority of farmers (78%) supplied seed informally to 1–10 fellow farmers, while 18% of farmers distributed seed to >10 fellow farmers.

In the case of pigeonpea, each farmer sold/distributed seed to an average of 8 fellow farmers informally. Again, the majority of farmers (81%) supplied seed informally to 1–10 fellow farmers, while 11% of them distributed seed to >10 fellow farmers. As discussed previously, the current low market price for pigeonpea due to the lack of demand from the Indian export market restricted informal seed spread as many farmers shifted to other crops. Farmers who grow pigeonpea as an intercrop (in some areas of the CDZ, this would account for virtually all farmers) are less interested in improved cultivars because they believe there is no productivity difference between them and the cultivars/landraces they currently grow.

With groundnut, each VSB farmer sold/distributed improved cultivar seed to just 3 fellow farmers on an average. This was primarily due to issues of seed production and multiplication. None of the groundnut farmers distributed seed to >5 fellow farmers. The majority of farmers retained their output to meet their own seed needs. On a few occasions, farmers sold seed in the open market at a higher price and some returned poor quality seed to the DoA for further distribution. All these factors adversely impacted the spread of improved groundnut cultivars from farmer to farmer.

Table 6.12 Number of indirect seed beneficiaries.

VSB farmer type	Average no. of indirect seed beneficiaries	Range of indirect seed beneficiaries	Farmer (%)
Chickpea (N=23)	10	None	4
		1–5	30
		6–10	48
		>10	18
Pigeonpea (N=135)	8	None	8
		1–5	38
		6–10	43
		> 10	11
Groundnut (N=24)	3	None	8
		1–5	92
		6–10	0
		> 10	0

Table 6.13 Potential impact of farmer-to-farmer informal seed distribution in the CDZ.

VSB farmer type	Year first seed obtained by VSB farmers	No. of VSB farmers	No. of farmers receiving improved seed informally			
			2016-17	2017-18	2018-19	Grand total
Chickpea	2015-16	40	400	2,400	12,400	
	2016-17	106	-	1,060	6,360	23,850
	2017-18	123	-	-	1,230	
Pigeonpea	2015-16	126	1,008	5,040	21,168	
	2016-17	361	-	2,888	14,440	48,064
	2017-18	440	-	-	3,520	
Groundnut	2015-16	14	42	126	294	
	2016-17	49	-	147	441	1,302
	2017-18	84	-	-	252	
Grand total		1,343	1,450	11,661	60,105	73,216

The potential overall impact of informal farmer-to-farmer distribution of improved cultivar seeds during 2015–2018 is summarized in Table 6.13. To estimate the number of farmers receiving the seed informally, it was assumed that each VSB farmer distributed seed to either 10 (chickpea), 8 (pigeonpea) or 3 (groundnut) farmers in the first year following the receipt of seed from the DoA (see Table 6.12). We then assumed the VSB farmers distributed to the same number of different farmers in the second and third years. We assumed that all such recipients would in turn distribute seed to a fewer number of other farmers, i.e. 5 (chickpea), 4 (pigeonpea) and 2 (groundnut). Based on those assumptions, we estimated the potential farmer-to-farmer distribution during 2016–18 to be about 73,000 farmers. This number does not include the 1,343 farmers who originally received the seed from the DoA.

6.6 Perceived benefits and issues with the VSB program

The perceived benefits of the VSBs and various issues faced by the surveyed farmers are summarized in this section. Across the three legumes, majority (86–96%) of the farmers reported they had benefitted from improved access to quality seed (Table 6.14). The majority (73–92%) indicated an increase in productivity using seed of improved cultivars. These benefits, however, did not translate into any reduction in seed costs. On a more positive note, the majority of farmers reported that their awareness and knowledge of seed saving (51–63%) and crop production (53–75%) had improved. The capacity building training programs organized by the DoA on seed production have clearly benefitted the farmers. However, only 40% of those surveyed had undergone these trainings. There is a need to strengthen such training programs in the region.

Table 6.14 Surveyed farmers' perceived benefits from the VSB program.

VSB farmer type	Status	Access to quality seed (%)	Productivity per ha (%)	Seed cost per acre (%)	Seed saving and awareness (%)	Knowledge about cultivation (%)
Chickpea (N=23)	Decreased	0	0	4	0	0
	No change	9	17	90	37	43
	Increased	91	83	6	63	57
Pigeonpea (N=135)	Decreased	0	1	3	0	0
	No change	14	26	90	49	47
	Increased	86	73	7	51	53
Groundnut (N=24)	Decreased	4	4	12	0	4
	No change	0	4	84	42	21
	Increased	96	92	4	58	75

Table 6.15 Surveyed farmers' major issues with the VSB program.

VSB farmer type	Issues with seed production	Issues with marketing and distribution	Other suggestions
Chickpea (N=23)	- Moisture stress during crop period - Wilt disease - Pest attacks	- DoA should buy back seed - No seed storage facilities - No purchase of seed from private seed company	- Explore a continuous pipeline of improved cultivars - Provide scientific and on-farm storage facilities and awareness - Provide seed production training
Pigeonpea (N=135)	- Weather played a significant role - Seed quality and purity issues - Needs capacity building	- Seed prices are not remunerative - High price fluctuations - DoA should buy back seed - No seed storage facilities at DoA - Limited purchase of seeds by private seed companies	- Extend to other crops as well - Awareness about scientific storage methods - Strengthen buy-back system - Explore continuous pipeline of improved cultivars
Groundnut (N=24)	- Low seed purity - Needs capacity building/ training - Timely supply of seed - Excessive rains impact production	- Non-remunerative prices - DoA should buy back seed - No seed storage facilities at DoA - No purchase of seeds by private seed companies	- Provide scientific and on-farm storage facilities and awareness - Increase awareness about seed systems

The major issues with the program as perceived by the farmers are summarized in Table 6.15. In the case of chickpea, moisture stress and outbreak of wilt were the most common production problems. For the other crops, it was the weather, i.e., too much rainfall and seed quality/purity. The seed buy-back arrangements by the DoA for all three legume crops were deemed unsatisfactory and farmers were forced to sell seed wherever and to whoever they could. There was a consensus across the three crops that DoA should buy back all seed produced by the VSBs and distribute it. Also, there was a consensus that the sales to private seed companies were either non-existent or very low.

Feedback indicated a strong need for strengthening infrastructure for seed storage at DoA township offices and that cost-effective on-farm storage methods need to be demonstrated and scaled up over time. As with most of the other issues raised by the farmers, there was a consensus across the three legumes that farmers involved need to be well trained in seed production and seed systems. All the farmers were expecting a continuous pipeline of improved cultivars to sustain their long-term interest in the scheme.

The surveyed farmers were asked about their willingness to continue in the program. Responses are summarized in Table 6.16. The majority (86–96%) responded positively. A small proportion (13%) who did not want to continue may have been influenced by falling legume prices causing financial stress and

Table 6.16 Willingness of surveyed farmers to continue in the VSB program.

VSB farmer type	Willingness to continue in VSBs	Farmers (%)
Chickpea (N=23)	Yes	87
	No	13
Pigeonpea (N=135)	Yes	86
	No	14
Groundnut (N=24)	Yes	96
	No	4

dampening seed demand, whose impact was felt the most during the survey period when some of the surveyed farmers were looking for alternative crops to grow.

6.7 Impact of improved cultivars

This section of the report examines the impact of improved cultivars on productivity gain (grain yield) and on the reduction in unit (basket) cost of production. The comparisons assumed all factors in cultivation, such as soil, climate and other management practices etc., were constant. The only variable was the cultivar. At the same time, information was collected from VSB farmers on the costs of production. Data from a selection of surveyed VSB farmers on yields and costs of production are presented. The decision to include individual farmer data was based on farmer responsiveness and their perceived level of understanding of the survey and its objectives. Thus, the numbers of surveyed VSB farmers used in this part of the impact assessment totaled ca. 25 for each crop.

6.7.1 Impact on productivity (grain yield)

Comparisons in pigeonpea yields between the improved VSB and old cultivars are presented in Figure 6.4. Pigeonpea is more commonly grown as an intercrop and also grown as a sole crop. Thus, intercrop and sole crop data are presented separately for the different township areas.

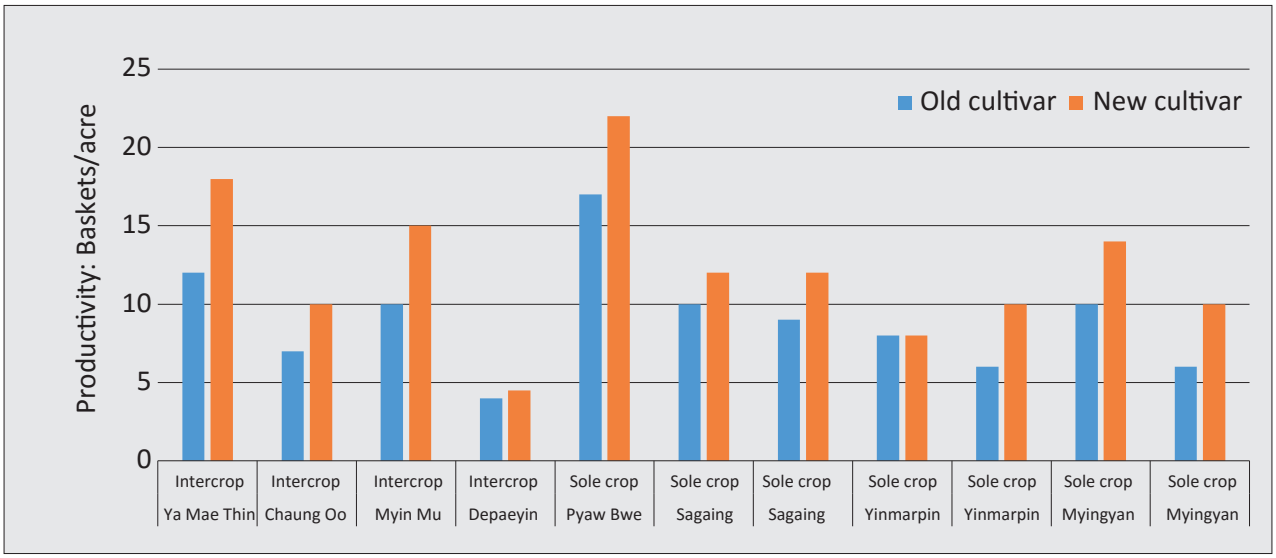

Figure 6.4 Yields from new (improved) VSB and old cultivars of pigeonpea in different townships.

In virtually all comparisons, improved VSB cultivars outyielded the old/ traditional cultivars/landraces. Increases ranged from 13–50% for the four different intercrop comparisons and from 0-67% for the seven sole crop comparisons. There were substantial differences in yields among the township areas, with highest yields of 18 baskets/acre (1.5 t/ha) in intercropped pigeonpea recorded in Ya Mae Thin for improved cultivars compared to 12 baskets/acre (1.0 t/ha) for traditional cultivars.

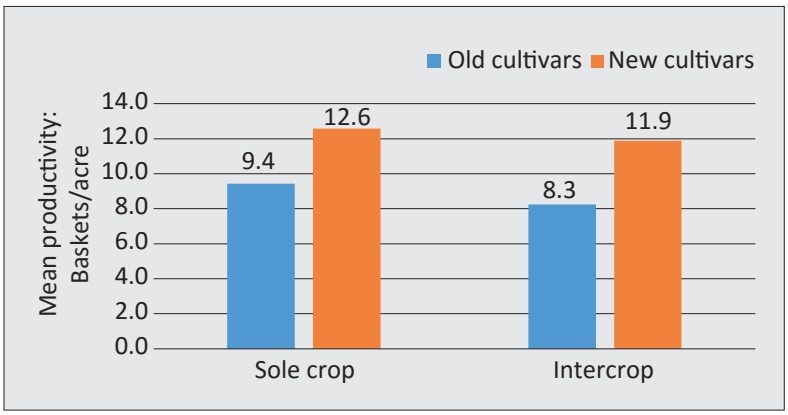

Figure 6.5 Impact of improved VSB cultivars on productivity of pigeonpea.

For sole cropped pigeonpea, the highest yields of 22 baskets/acre (1.8 t/ha) were recorded in Pyaw Bwe for improved cultivars compared to 17 baskets/acre (1.4 t/ha) for traditional cultivars.

Productivity levels of old/traditional versus new improved cultivars of intercropped and sole pigeonpea are presented in Figure 6.5. For sole pigeonpea, the average yield increase from improved VSB cultivars was 3.2 baskets/acre (34%), compared to the old cultivars. With intercropped pigeonpea, the average increase was 3.6 baskets/acre (43%).

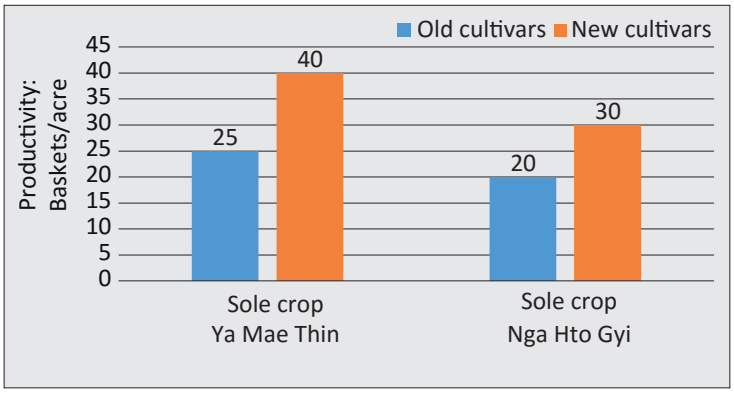

Figure 6.6 Impact of improved VSB cultivars on productivity of groundnut.

It was interesting to note that the yield increase was slightly higher, in absolute and relative terms, for intercropped pigeonpea because farmers have quite a different view about the need for improved cultivars when pigeonpea is grown as an intercrop. In such systems, their focus is on the other crops in the systems, e.g. groundnut, sesame, etc., with pigeonpea receiving less attention. Of course, more attention is paid to pigeonpea when it is grown as a sole crop. In such systems, they see a clear need for improved cultivars. Impacts of improved cultivars on productivity of groundnut are summarized in Figure 6.6. For each township, there was a substantial increase with the improved VSB cultivar, 15 baskets/acre (60%) in the case of Ya Mae Thin Township and 10 baskets/acre (50%) in Nga Hto Gyi.

A comparison of chickpea yields between improved VSB and old cultivars in the different township areas are presented in Figure 6.7. Improved VSB cultivars outyielded the old/traditional cultivars in all 8 townships, with yields ranging from 20–100%. As with the other legume crops, there were substantial differences in yields between townships, with the highest yield of 23 baskets/acre (1.8 t/ha) recorded at Myingyan for improved cultivars compared to 15 baskets/acre (1.2 t/ha) for traditional cultivars.

An overall summary of productivity levels of old/traditional versus new improved cultivars of chickpea is presented in Figure 6.8. The average yield increase from improved VSB cultivars was 6.5 baskets/acre (52%). The farmers were very happy because market prices were relatively stable and there was increasing domestic demand.

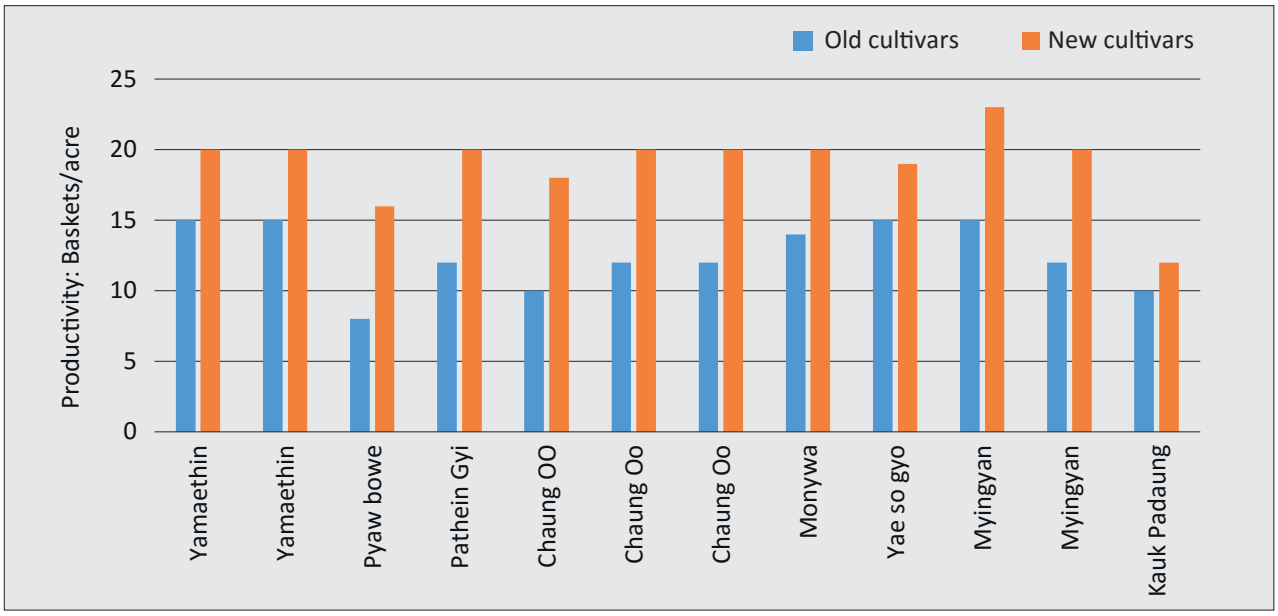

Figure 6.7 Yields of new (improved) VSB and old cultivars of chickpea in different townships.

6.7.2 Impacts on profitability (price, cost and net margins)

The final assessment in the survey focused on the economics of cultivating improved cultivars, compared with old/traditional cultivars. Farmers were asked to detail costs of production and to provide prices for grain and any other products associated with the crops, e.g., fodder.

The average cost of production of improved VSB and old/traditional cultivars of pigeonpea, grown as a sole crop and also an intercrop, together with the unit (i.e. basket) cost reduction (UCR) are presented in Figure 6.9. For sole pigeonpea, the cost per basket was reduced by 25% when old/traditional cultivars were substituted with improved VSB cultivars. For intercropped pigeonpea, there was a 27% reduction in unit production costs. The UCRs for the improved VSB cultivars were 4,998 and 5,442 Kyats for sole and intercropped pigeonpea, respectively.

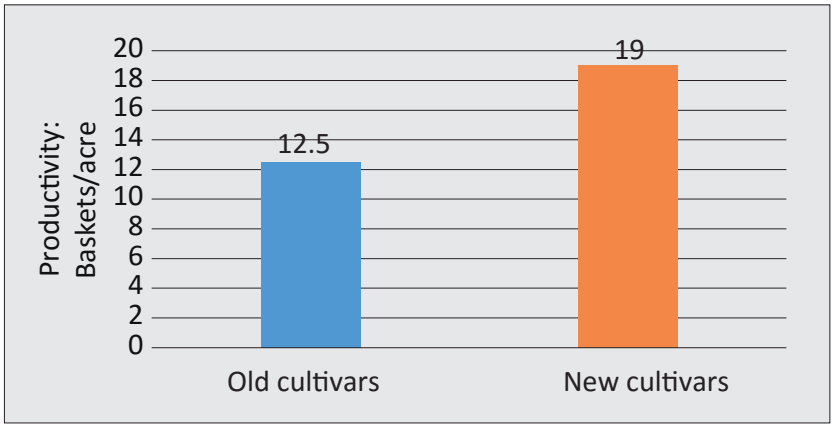

Figure 6.8 Impact of improved VSB cultivars on productivity of chickpea.

The cost of production of improved VSB and old/traditional cultivars of groundnut for the two townships of Ya Mae Thin and Nga Hto Gyi, together with the unit (i.e. basket) cost reduction (UCR) are presented in Figure 6.10. In Ya Mae Thin, the cost per basket was reduced by 37% when old/traditional cultivars were substituted with improved VSB cultivars. In Nga Hto Gyi, there was a 33% reduction in unit production cost. The UCRs for the improved VSB cultivars were 4,365 Kyats and 5,783 Kyats for Ya Mae Thin township and Nga Hto Gyi township, respectively.

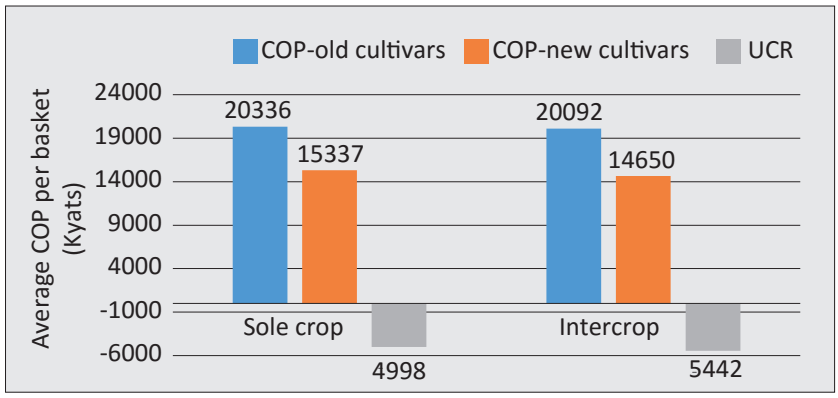

Figure 6.9 Cost of production of improved VSB and old/traditional cultivars of pigeonpea when grown as a sole crop and an intercrop [COP = cost of production (Kyats/basket) and UCR = unit cost reduction (Kyats/basket)].

The average cost of production of improved VSB and old/traditional cultivars of chickpea, together with the unit (i.e. basket) cost reduction (UCR) are presented in Figure 6.11. The cost per basket was reduced by 30% when old/traditional cultivars were substituted with improved VSB cultivars. The UCR for the improved VSB cultivars was 6,175 Kyats.

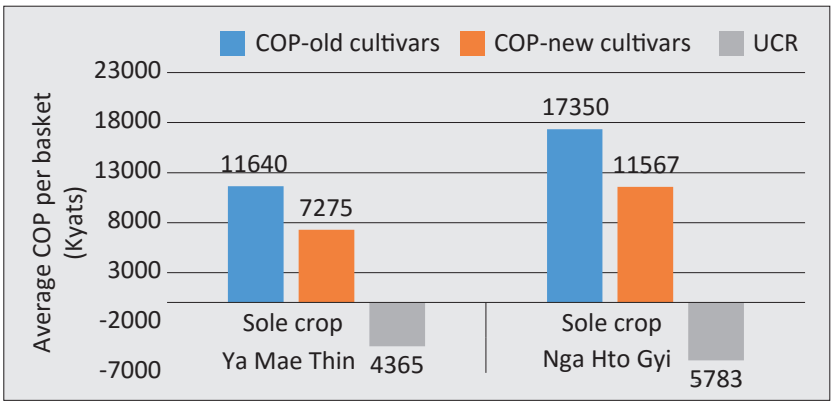

Figure 6.10 Cost of production of improved VSB and old/traditional cultivars of groundnut [COP = cost of production (Kyats/basket) and UCR = unit cost reduction (Kyats/basket)].

With all crops, the UCRs of growing improved VSB cultivars were mainly associated with their increased yields. The average cost of sole cropped pigeonpea was slightly less for the improved VSB cultivars (182,971 Kyats/acre) compared with the old/traditional cultivars (186,000 Kyats/acre) (Table 6.17). This might have been due to their tolerance to pests and diseases and reduced use of pesticides. The average cost of intercropped pigeonpea was the same for improved VSB and old/traditional cultivars at 149,500 Kyats/acre. Similarly, the average cost of groundnut cultivation was essentially the same (319,000 Kyats/acre) for improved VSB cultivars and local/traditional varieties. In the case of chickpea, the average cost was slightly higher for improved VSB cultivars (271,433 Kyats/acre) than for the old/traditional cultivars (254,142 Kyats/acre). This might have been due to increased investment in better crop management practices and inputs.

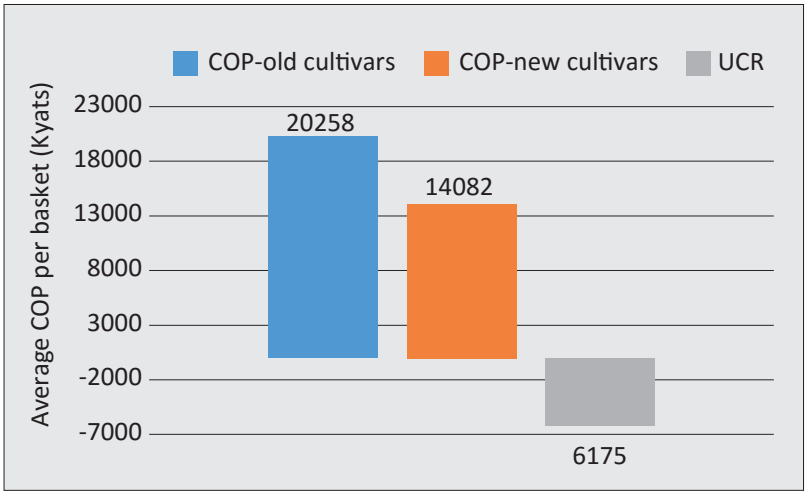

Figure 6.11 Costs of production of improved VSB and old/traditional cultivars of chickpea [COP = cost of production (Kyats/basket) and UCR = unit cost reduction (Kyats/basket)].

Prices received for the grain/seed varied from 32,000–35,000 Kyats/basket for chickpea to 10,000–12,000 Kyats/basket for groundnut and 22,000–25,000 Kyats/basket for pigeonpea. The improved VSB cultivars attracted a premium of 2,000–3,000 Kyats/basket for both chickpea and groundnut.

Net margins for the improved VSB varieties and old/traditional varieties were calculated taking the costs of production and prices received (Table 6.17). It was not possible to calculate the gross margins because family labor and hired (outside) labor were not differentiated in the survey.

Each crop revealed a clear economic advantage of using improved VSB cultivars. Improved net margins were 264,125 Kyats/acre for chickpea, 177,000 Kyats/acre for groundnut and 86,314 and 84,625 Kyats/acre for sole cropped and intercropped pigeonpea, respectively.

Finally, the study also made an attempt to estimate the extent of benefits accrued to total VSB farmers based on the above findings. The cumulative research benefits due to the adoption of 'MyPulses' improved cultivars was calculated approximately at USD 25 million to 40 million per year. This clearly emphasizes the importance of crop genetic improvement impacts on incomes and livelihoods of small and marginal farmers in the country. So, the VSB program needs to be strengthened further by addressing the flagged issues for its long-term viability as well as sustainability.

Table 6.17 Economics of pigeonpea, groundnut and chickpea cultivation among the surveyed VSB farmers.

	Cost/acre (Kyats)		Net margin/acre (Kyats)	
Crop	Old cultivar	Improved VSB cultivar	Old cultivar	Improved VSB cultivar
Chickpea	254,142	271,433	172,525	436,650
Pigeonpea (sole)	186,000	182,971	23,786	110,100
Pigeonpea (Intercrop)	149,250	149,875	30,500	115,125
Groundnut	319,000	319,000	-62,250	114,750

6.8 Feedback from the surveyed farmers and survey team

Following are some additional comments made by the surveyed VSB farmers and observations by the survey team.

6.8.1 Pigeonpea

- Many of the surveyed farmers opined that the cropped area under pigeonpea depended upon prevailing market prices and export demand.
- Monywa Shwe Din Gar was the preferred cultivar by a majority of surveyed farmers as it performed well under normal weather conditions. However, it did not perform well under low or excessive rainfall.
- For the most part, farmer-to-farmer seed exchanges were prevalent at prevailing market prices. The barter system of seed exchange was almost absent. In a few townships (e.g., Myingyan), multiplied seed was procured by private seed companies (e.g. 999) for export but the VSB farmers were not paid a premium price. Informal diffusion of seed was not apparent in and around Monywa township because of the strong presence of cooperatives and private seed companies.
- The farmers who grew pigeonpea as an intercrop, especially in Kyaukpadaung, Pwint Phyu and Salin townships, did not prioritize the use of improved pigeonpea because they did not perceive any benefit. However, survey data (Figures 6.5, 6.9 and Table 6.17) clearly showed productivity and profitability benefits from improved VSB cultivars that were higher when pigeonpea was intercropped rather than grown as a sole crop.
- Strengthening storage infrastructure at townships and promoting cost-effective on-farm storage facilities are major priorities to be able to capitalize on the potential long-term benefits of introducing new improved cultivars.

6.8.2 Chickpea

- The majority of surveyed VSB farmers felt that chickpea market prices were stable due to increasing domestic demand and export opportunities beyond India.
- The improved VSB cultivars, Yezin-4, Yezin-6 and Yezin-12, performed extremely well. However, the surveyed farmers also highlighted problems of wilt and pest attacks in a few townships. Farmers were well aware of the new chickpea cultivars.
- Farmer-to-farmer seed exchange was taking place at prevailing market prices. There was no proper buy-back mechanism for the purchase of multiplied seed either via private seed companies or through the DoA. Significant quantities of seed produced by the VSB farmers were being diverted to open grain markets due to lack of awareness of the value of the seed and the absence of storage facilities.
- Investments in research on biotic and abiotic stresses is key to sustaining the long-term interest of the chickpea growers in Myanmar.

6.8.3 Groundnut

- Groundnut was one of the most profitable crops grown by the surveyed VSB farmers, followed by sesame, pigeonpea and paddy (rice). As a consequence, farmers' gave due importance to its cultivation.
- The majority of VSB farmers indicated that Sinpaditha-11 was a good and high yielding cultivar, and better than local landraces. The percentage of oil extraction was also higher than in other improved cultivars. It performed well under drought conditions but not under heavy rainfall, especially during flowering and pegging stages. Due to various reasons, the improved cultivar showed more limited spread than anticipated.

- Both surveyed farmers and township managers cited the storage of groundnut seeds as the biggest issue, rendering it susceptible to storage pests, moisture loss and reduction in seed viability. Low genetic purity and low germination percentages are other issues the surveyed farmers underlined. The DoA was not receiving good quality seed from the VSB farmers because they appeared to mix improved seed with those of other (old) cultivars. Their intention was to retain the seed for further expansion on their farms or to sell in the open market to fellow farmers.
- Developing sustainable seed chains coupled with storage facilities are urgently needed for the rapid diffusion of improved cultivars.
- Substantial economic impacts are likely if future investments are focused towards efficient and effective seed systems.

7. Conclusions

The VSB program, instigated and managed by the DoA, appears to have been successfully implemented with a total of 1,343 farmers from 495 villages receiving good quality seed of improved cultivars from the DoA during 2015–18. Using data from the 182 VSB farmer survey, we estimated them to be producing improved cultivar seed on 3,400 acres in 2017–18 and the potential informal, i.e. farmer-to-farmer, spread of the improved cultivars to include another 73,000 farmers. The productivity and profitability gains from the use of VSB cultivars were impressive. The seed production training programs were effective and beneficial to the VSB sample farmers. However, the extent of coverage was limited and needs to be expanded. The other major issue was the lack of seed storage facilities and an underdeveloped marketing program for VSB-produced seed.

Annexure 1

Impact Assessment of the Village Seed Bank (VSB) program for chickpea, groundnut and pigeonpea in the Central Dry Zone of Myanmar, focusing on improved cultivar seed production, distribution, productivity and profitability

ACIAR-DAR-DoA-ICRISAT Collaborative Project

Province name:	Township name:	Village name:
GPS Readings:		

1. Household head name: Mobile no:

2. Father's name:

3. Age of household head:

4. Education years completed:

5. Family size: No.participate in Agril:

6. Landholding size: Irrigated: Rainfed:

7. Area used to grow different pulses:

Crop name	Area (acres)	Season	Variety names	Source of seed
Pigeonpea				
Chickpea				
Groundnut				
Black gram /urad				
Green gram/mung				
Source code: a= own seed, b=borrowed from fellow farmer, c= from DAR/DoA/Township manager, d= village seed bank, e= purchased from local market and f= others.				

8. Distance to following places (kms)

a) Research station/Agril. information centre /DoA office	
b) Seed dealer /seed market	
c) Regulated market	
d) Distance to storage facility	

9. Are you aware of Village Seed Banks (VSB) in your village? Yes or No

If yes, when did you first hear about it: 2014 / 2015 / 2016 / 2017

10. Did you obtain seed from DoA/DAR/Township manager under VSB: Yes / No

If yes, can you provide the details below?

Crop	When year (tick)			Total qty. of seed obtained	Variety names
	2015-16	2016-17	2017-18		
Pigeonpea					
Chickpea					
Groundnut					

11. Did you plant new variety seeds? Yes or No

If yes, provide the details below:

Crop	Area planted with new seed over time			
	2015-16	2016-17	2017-18	2018-19
Pigeonpea				
Chickpea				
Groundnut				

12. Which cultivars did you grow previously?

Crop	Name of previous cultivars	Major sources of seed
Pigeonpea		
Chickpea		
Groundnut		
Source code: a = own seed, b = borrowed from fellow farmer, c = purchased from local market, d = provided by DAR/DoA/Township manager and e = other.		

13. Perceptions about new cultivars obtained through VSB scheme

Crop	Perception about new cultivars compared with the old	Reasons if not performed well/ drawbacks	Reasons if not expanded area under new cultivars
Pigeonpea			
Chickpea			
Groundnut			
Perception code: a = bad performance, b = satisfactory, c = good and d= Excellent.			

14. Output utilization pattern of new VSB cultivars, 2017-18 (*in baskets*)

Crop	Total output	Consumed including payment of in- kind wages	Kept as seed for next season	Given back to VSB	Sold as seed to other farmers	Sold as seed to private companies	Others
Pigeonpea							
Chickpea							
Groundnut							

15. How do you normally store pulse seeds: a)..... b).....

16. Did you face any problems in pulse seed storage: a) ..... b).....

17. How often do you replace seed of different crops?

Crop	How often seeds were replaced (code)	How did you replace seeds (code)	Reasons/remarks
Pigeonpea			
Chickpea			
Groundnut			
Green gram			
Black gram/Urad			
Rice			
Soybean			
Maize			
Sesame			
Sunflower			
Source code: a = every year, b= once in two years, c= once in three years, d= never, and e= not planned. Replacement codes: a= purchased new seed, b= borrowed from neighbor, c= obtained from DAR/DoA/TS, d= others.			

18. Did you share improved pulses seeds with fellow farmers? Yes or No

If yes, please provide details

Crop	Variety name	How much area in your farm is covered with new cultivars (%)?	With how many farmers did you share or sell the seeds in			Remarks
			2015-16	2016-17	2017-18	
Pigeonpea						
Chickpea						
Groundnut						

19. In general, with who do you share the pulse seeds?

Type of members	If yes (just tick)	Why, reasons?
With most progressive farmers in village		
With all known farmers in the village		
With all my relatives		
With all my friends		
With those who approached me		
Just sold it in the village		
Others		
Did not share		

20. Extent of indirect seed beneficiaries

Crop	How many farmers benefited from the new seed you shared	How many of them are in your village?	How many farmers might have received new seed in the village?	Approximately, how much area in your village is covered with new seed (%)?
Pigeonpea				
Chickpea				
Groundnut				

21. Did you undergo any crop/seed production training from DoA/DAR/Township office? Yes or No

Name of training program	Year	No. of days	Feedback

22. Perceived benefits from the Village Seed Bank Scheme / Training programs?

Item	Rating (tick any one)		
	Decreased	no change	Increased
Access to quality seed			
Information to obtain higher yields			
Information to reduce seed cost per acre			
Awareness about seed systems/seed saving			
Knowledge about cultivation			

23. Issues and suggestions in Village Seed Bank Scheme

Issues	Suggestions

24. Are you willing to continue in the Village Seed Bank scheme in future? Yes or No

If No, reasons 1) ..... 2) .....

25. Did you face any difficulties in seed production and marketing?

Issues in seed production	Issues in seed distribution/marketing

26. Volume of informal seed systems

a) How many farmers like you are members in VSBs?	
b) How many farmers benefitted (directly and indirectly) through VSBs in the village?	
c) What is the share of the total beneficiary farmers in the total village (%)?	

27. Impact of new improved seeds

	Crop name:		Crop name:		Crop name:	
Variety name						
Sole/intercrop						
Season (Kharif/Rabi/ Summer)						
Irrigated/dry						
Operation	Costs (Kyats per acre)		Costs (Kyats per acre)		Costs (Kyats per acre)	
	Old cultivar	New cultivar	Old cultivar	New cultivar	Old cultivar	New cultivar
Land preparation						
FYM/Compost						
Seed costs						
Sowing costs						
Fertilizer costs						
Micronutrient costs						
Inter-culture costs						
Weeding costs						
Plant protection costs						
Irrigation costs						
Harvesting costs						
Threshing costs						
Marketing costs						
Others costs if any						
Grain-pod yield (BSK)						
Price (Kyats) /BSK						
Dry fodder yield						
Price						
Other income, if any						

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