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Final Report

November 2013

General Information

Project Name:	Incentives Driving Economic Alternatives – North, East, West (IDEA-NEW)
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Project Director:	Peter How
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Summary

Basic actual vs. target deliverables are summarized in figure 2, and for main, easily quantifiable financial benefits to farmers, a summary is given in figure 3. These present that more than 7,000 farmers have been involved in more than 34,000 trainee days over these three years, bringing more than 17,000 ha into improved cultivation and returning an increased 2,249,681 USD per year.

A lively peer to peer learning environment prevails among farmers. Two examples include: trainees who went away from a specialist weed control group, and through their own initiative, further trained groups of peers, sharing their newly acquired know-how; and by the way new varieties spread along indigenous uptake pathways: something we've been able to clearly identify for safflower since it is a new crop extended primarily through IDEA NEW's work. These uptake pathways are important, because the project's methodologies are designed to recognize and leverage them. In combination with accessible technologies for improving agriculture we feel that our outcome figures presented here are achieved sustainably, increase over time, and are conservative.

Challenges remain in this somewhat uncertain and insecure environment. What an outsider may consider a small change or investment, may be a huge risk, commitment, or undertaking for a particular farmer, and far from lazy, many farmers' careful observation of early adopters to fully assess new technologies is sensible, wise, and simply necessary for them. Another area of challenge is that human capacity has been under-invested in across all stakeholder groups: this means our own organisations are affected also. However, this project has emphasized scaling up technologies which have been broadly proven in previous work, and thus we have seen some notable success as well as to learn for future work.

The different activities have been designed to complement each other and provide improved access across the program. Farmers, department of agriculture staff, faculty, and the private sector have different needs, but even within these groups learning styles and needs can vary. In the field we've used large groups as a way of entering communities, starting relationships, and reviewing a range of technologies. This has been a gateway to more specialized and smaller trainings which foster contact over time and adequate quality input – two aspects which farmers require to achieve lasting change in their fields.

While our work with two-wheel tractors has sometimes over-emphasized the failure to meet initial project sales targets, it has also been miss-interpreted at times. Currently more 2WTs are active in Afghanistan's northern 5 provinces through USAIDs work than were planned for at the beginning of IDEA NEW. This is due to a previously unforeseen USAID project activity of AVIPA, which sold more than 1,000 2WTs in these provinces at prices below their salvage value, many to farmers who were familiar with the 2WT through IDEA NEW's work. Poor initial training of those beneficiaries resulted in a number of problems, but IDEA NEW implemented training for those AVIPA beneficiaries, and most tractors are now being valued and used productively.

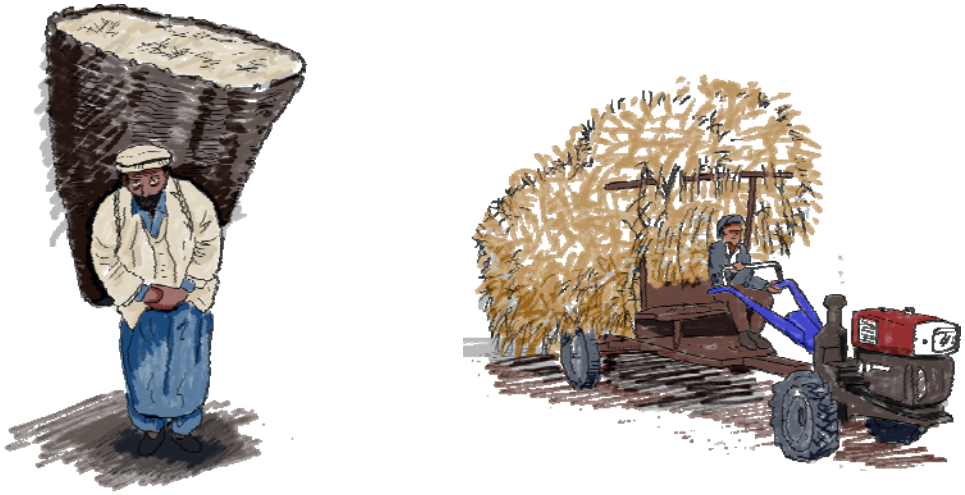
This report is presented in sections relating to the 7 activity areas and their deliverables established in contract modification 6, but including the entire contract's components going back to October 1, 2010. Of course this is a (necessary) simplification since the outcome of one activity is not independent of the others but all are mutually enhancing.

The tabulated figures 2 and 3 are an adequate quantitative summary of the project,

but the following illustration acts as a window on 2WTs as a lever of change.

Levers of change

Figure 1 Levers of change: 2WTs



The farmer on the left takes 20 days to cultivate his land – just about every available working day during the planting season. He has to use high seed rates and much of his seedbed fertilizer is wasted because it is broadcast, and land preparation is crude. He feeds his oxen every day of the year but only works them for 50 and struggles to find time for NGO trainings or visits to the agricultural department when he finds the seed he is given is sub-standard. At harvest time he can't find labourers willing to cut his wheat and ends up paying 30% of his grain for harvesting and threshing. He has to sell the rest to pay his debts but relies on an aggregator who comes to his village offering low cash prices.

The farmer on the right took a risk. He sold his oxen for the price of a subsidized tractor. He cultivates his land in 5 days, and can work the other 15 for his neighbors earning cash: he is appreciated in his community because it costs half the price of their oxen or a 4WT and does a great job. Every morning he has time to rest after dawn prayers and eat breakfast with his family when his sons thank him that they are not out gathering feed for their oxen. At harvest he can cut his wheat in a day, so none is lost through shattering. He can now grow a second season crop early. He shares a trailer with a neighbour and they can take goods to market and get good prices. His extra time and profitability make attendance at trainings easier or allows him to work with a nearby workshop which is beginning to innovate with new implements for 2WTs suited to his particular needs: he has more time to consider and invest in other improvements to his farming system.

Summary of project achievements against targets

Figure 2 summary of project achievements against targets

8200.28 IDEA NEW - JDA, Farmer Training and Small Scale Mechanization
Deliverables - Target vs Actuals (2010-2013)

No	Item	Unit	Deliverables	Actual	% Completed
	Activites and Deliverables				
1.1	**Crop demonstrations**	Number	83	84	101
1.2	**Farmers who have attended 3 field days at crop demos**	Number	8,900	5,739	64
1.3	**Trainee days**	Number	26,700	25,814	97
2	**Demos of improved tillage and seeding with 4 wheel tractors**	Number	7	10	143
3	**6 min-tillage contractors**				
	60 ha of land sown with incentives	Number	60	140	233
	6 Active Contractors	Number	6	5	83
4.1	**23 wheat and 6 safflower PVS being assessed: 690 farmers exchanging wheat; 54 safflower**				
	54 Farmers in Safflower PVS	Number	54		-
	23 Wheat Varieties in on-farm testing	Number	23	37	161
	20 PVS Sites with DAIL Leadership	Number	20	19	95
	300 Farmers involved in 20 PVS Sites	Number	300	646	215
	5 Extension Agents taking leadership	Number	5	11	220
	Improved processing and market access	Number			
4.2	**15 extension workers delivering training to farmers**				
	Training days	Days	120	192	160
	Production of weed control syllybus	Number	1	1	100
5	**Owner/operators of 2W Tractors providing services to farmers**				
	300 2WT Sales LoP	Number	300	280	93
	Providing services on 10,000 ha land	Number	10,000	9,800	98
	Earning 87,000 USD	$	87,000	300,877	346
6	**Specialised small group trainings**	Trainee Days	2,160	2,181	101
7	**Sustainable research at hubs in balkh, faryab and soil lab**				
	Three technitions trained at soils lab	Number	3	3	100
	50 extension agents, INGO, NGO agriculturalists trained in sampling	Number	50	57	114
	100 University Students trained	Number	100	220	220
	100 Soil samples analysied with location data	Number	100	275	275
	Trials on 10 jeribs of land	Number	10	10	100
	Edited trials documents produced	Number	1	1	100

Summary of main financial benefits from project

Figure 3 summary of main financial benefits from project

No	Item	Unit	% uptake	ha / person	total ha	USD / ha	total USD
	Activities and Deliverables						
1	**Crop demonstrations and 2WT Sales**						
	277 2WTs sold, 5,739 course attendees						
		Improved Seed	98%	2.64	14,848		
		Reduced Seed Rates					
4		Use of 2WT for cultivation	65%	2.64	9,848	104	1,024,205
		Use of 2WT for harvesting	35%	2.64	5,303	134	710,580
		Improved weed control	53%	0.69	2,099	103	216,171
2	**Improved tillage and seeding with 4 wheel tractors**						
	5 contractors with over 200 ha capacity each, 198 farmers						
		Improved Gross Margin	20%	5.00	198	247	48,906
3	**PVS Courses**						
	646 additional farmers						
		Improved Seed	80%	2.64	1,364	91	124,736
		Improved Weed Control	125%	0.69	557	103	57,389
6	**Specialized small group trainings**						
	762 small group participants						
		2WT owners					
		Weed Control Trainings	125%	0.69	657	103	67,694

More than 7,345 different farmers, 17,068 ha under improved cultivation with 2,249,681 USD / year improved profitability thanks to this project

Basic agronomy and appropriate mechanization trainings

Introduction

A course of 4 field days has been a core activity in the IDEA NEW project: providing training, an entry point to other activities, and the development of linkages between farmers and other stakeholders.

Photo 1 basic agronomy course component: seed treatment

'sior khok' or 'smuts' are widespread wheat diseases in Afghanistan and can be treated easily for about 1 USD per ha, but few farmers know about this. Here a trainee protects his crop with fungicide.

The course introduces farmers to improved agronomic options ranging from seed selection and treatment to mechanized harvesting and marketing primarily for wheat-based systems. Several course components are then covered in separate more intensive short courses where farmers are given targeted training on a special interest component. Farmers evaluate a range of technologies, some of which will be readily adopted with no further introduction – such as seed treatment illustrated in Photo 1 for example, and some of which will be accessible to some and not others – bed planting or purchasing a 2WT tractor for example. Where technologies require further training or support this course is an entry point for interested farmers to other project activities.

The function of the course in facilitating linkages is also important and often results in unexpected positive outcomes. The course aids uptake of technologies by developing consensus, an important aspect for any type of technology adoption. We have seen in the case of mechanization that 2WT adopters have a more ready client base and greater profits in the early years of adoption when they have been involved in groups like this compared to individual innovators adopting without other project activities. We also recognize that as a third party we are able to bring people together who otherwise could not meet in the same space, either because they are from different parts of a village, or from several communities. We often see positive interactions between participants who otherwise have not been able to meet in other circumstances.

Department of Agriculture Irrigation and Livestock Involvement (DAIL)

48 DAIL extension agents worked with us through the project period: 22 worked for a single year, 13 for two years, and 13 for three. Project agronomists worked with a DAIL extension agent for each district. Close collaboration with DAIL throughout activities and formal trainings at JDA forms an effective in-service training package.

Government extension agents have rarely been resourced to get into the field. They are not given the combination of training, confidence, support, or other resources they need to help farmers. Many projects train extension agents, but the training is not field tested; others send extension agents into the field, but again agents do not necessarily have the confidence to practice an untested technology. With IDEA NEW we have been able to train, mentor, and resource extension agents with formal and in-field elements supporting them in their professional development. In many cases this project has introduced DAIL extension agents to the farmers in their areas and vice versa for the first time.

Photo 3 DAIL extension agents receive training in a range of styles: here in a more formal setting before a round of field activities.

Photo 2 Shamsudeen, DAIL extension agent for Dawlatabad, Balkh, conducting a participatory ranking exercise with farmers.

Dawlatabad extension agent, Shamsudeen, left, said:

"Before this program we could talk about improved agronomy, but we couldn't show farmers; we've been able to actually show farmers in their fields and convince them. I had no idea how I would run a demonstration before, but now I could do it without help."

Challenges and lessons learned

Important changes to the basic agronomy course over the three project years were:

- Reduced group sizes
- Greater participation
- Improved access for farmers to technology components at an experimental scale, stimulating farmer testing and then demand.
- Improved coordination with other project components to increase repeat contact / support over time and improve training quality.

Photo 5 basic agronomy course component: inter-row weeding

Planting in lines is becoming possible for the first time with appropriate mechanization, which in turn makes simple mechanized inter-row weeding possible: this can reduce the time spent per ha weeding from 25 days to 2.

Photo 4 farmers inspect 2WT seeding performance at a field day.

Here farmers are searching for seed in a 2WT sown field. Traditionally these farmers hand broadcast and then plough in the seed; lots is left on the surface and these men cannot believe that seed has been sown or that it will germinate. When we meet with them at field day 2 when the crop has established they are amazed!

Figure 4 Concise training guide: basic agronomy and appropriate mechanization crop demonstration / course

Field Day 1: Land Preparation and Sowing

Crop Establishment

At FD1 you will be establishing a rapport with participants, introducing project hopes and objectives, JDAI, the program, and learning more about the specific participants and environment that this site is on. The technical content of this field day is all about working towards good crop establishment: vigorous, rapid, and full establishment is critical to achieving high and consistent yields. Farmers should see some land preparation and get a chance to get their hands on the 2WT if possible.

Field Day 2: Weed Control, Nutrition and Spring Planting

Weed Control and Nutrition

This field day allows farmers to see the excellent establishment you've achieved! If land prep and sowing were not carried out in the fall you may cover this here with spring crops. The main attention for FD2 is on the major problem of weeds. Use the leaflet as a tool for farmers to remember what you say. *Check if we are giving sprayers and backpack sprayer training – if so review separate training guide.*

Field Day 3: Harvest

Crop Review and Harvesting Financial Analysis

This is an excellent time for farmers to compare varieties – you may carry out a ranking exercise by voting for varieties in some way, e.g. ask farmers to stand by their favorites, then get them to explain their choices. Make a point of looking at weed control impact by observing check strips and discuss. Watch 2WT reaping wheat and carry out a cost comparison – you might use a participatory budgeting exercise on paper.

Field Day 4: Evaluation

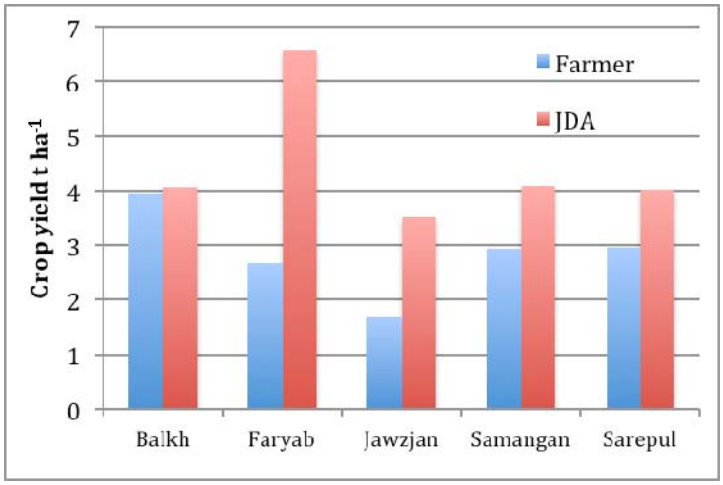
Review and Wrap up

This field day is a chance for a final review and to show farmer comparison yields for crops across the program and to challenge farmers to think about what they will implement themselves next year: you may finish the day by getting each to name a change they will bring on their own farms. Make sure you take a chance to ask questions for your own review of how useful your work has been and consider how you could improve it.

Yield Gap

Improving yield stability and system productivity or profitability are usually more important than single crop yield improvements. Nevertheless, having an idea of what can be achieved with a medium level input or management regime is useful for decision makers. In 2013 yields across our locations were high for farmers, but demonstrations still averaged 56% higher for wheat, which is a fairly typical difference across multiple project years.

Chart 1 Wheat yields at IDEA NEW demonstration sites and near neighbors, northern Afghanistan, 2013. Project sites averaged 56% higher yields. n=7,4,4,3 and 2 Balkh to Sare Pul respectively



Outputs

Group sizes in the first year were close to 100, in the final year they were close to 30. In total, 84 basic agronomy courses were run over the project period, training 5,739 people on more than 24,884 trainee days.

Basic agronomy courses were reduced in number and size as specialised courses were used in greater numbers over the project period in many cases allowing previous basic course participants to access higher level, more specialised trainings.

JDA aimed to have trainings in every district where security allowed.

Table 1 basic agronomy course locations and participant numbers 2010 - 2013

Province		Project Year			
		2010/11	2011/12	2012/13	Combined
Balkh	Courses	10	8	5	23
	Locations	10	8	5	23
	Farmers *	880	704	115	1,576
	Trainee Days	3,520	2,816	460	6,796
Samangan	Courses	4	3	4	11
	Locations	4	3	4	11
	Farmers *	412	285	84	726
	Trainee Days	1,648	1,140	336	3,124
Jawzjan	Courses	7	6	3	16
	Locations	7	6	3	16
	Farmers *	686	576	96	1,257
	Trainee Days	2,744	2,304	384	5,432
Sare Pul	Courses	4	4	3	11
	Locations	4	4	3	11
	Farmers *	336	372	96	734
	Trainee Days	1,344	1,488	384	3,216
Faryab	Courses	9	9	5	23
	Locations	9	9	5	23
	Farmers *	693	711	175	1,446
	Trainee Days	2,772	2,844	700	6,316
Total	Courses	34	30	20	84
	Locations	34	30	20	84
	People *	3,007	2,648	566	5,739
	Trainee Days	12,028	10,592	2,264	24,884

Districts include: **Balkh:** Dawlatabad; Dehdadi; Kaldar; Khulm, Nahre Shahi, Sholgara, and Shortapa. **Samangan:** Aybak; Hazrat Sultan; Feroz Nakchar; Khoram o Sar Bagh. **Jawzjan:** Faizabad; Aqcha; Khaja Dukoh; Shebrighan; Qarqin and Khamab. **Sare Pul**: Centre; Suzma Qala; Sangcharak. **Faryab:** Andkhoi; Khan Char Bagh; Qurghan; Pashton kot; Mymanar; Khojamosa; Khuja Sabzposh; Almar and Belcheragh.

* 15% subtracted from year 2 and 3 figures as estimate of repeat attendance.

Impact / Outcomes: Measuring Uptake

In 2010 IDEA NEW project partner ACDI VOCA surveyed 251 participants in JDAI's basic agronomy course. Uptake % are presented in table 2.

Table 2 technology uptake findings for basic agronomy course attendees

Province	2WT Land Preparation	Improved Seed	Seed Treatment	Sowed with 2WT	Herbicide	Harvested with 2WT
Balkh	67%	97%	97%	45%	75%	40%
Faryab	49%	100%	100%	8%	16%	29%
Jawzjan	77%	97%	97%	32%	37%	25%
Samangan	68%	100%	100%	68%	100%	65%
Sare Pul	60%	100%	100%	20%	20%	15%
Total	**65%**	**98%**	**98%**	**35%**	**53%**	**35%**

Financial Implications of Uptake for Farmers

Partial budgets for three financially important components are shown in figure 5. And figure 6 shows the activity total benefits when combined with uptake rates given in table 2.

Figure 5 Partial budgets for 3 key system component changes introduced in JDAI's basic agronomy courses

1. Partial Budgets: Switch from 4WT to 2WT Land Preparation

	USD ha^{-1}		USD ha^{-1}
Additional Income due to change:		Additional Costs due to change:	
Increased yields: improved timing, 5% on 2,000 kg ha^{-1}	30	Fees for 6 hrs at 6.14 USD hr^{-1}	37
Increased yields: improved field conditions, 2% x 2,000 kg ha^{-1}	12		
Reduced Costs due to change:		Reduced Income due to change:	none
Reduced fees for cultivations 4 hrs at 22.8 USD hr^{-1}	91		
Reduced seed cost due to higher emergence	8		
Sub-total	141	Sub-total	37

gross marginal change = 141 - 37 = 104 USD

2. Partial Budgets: Switch from hand harvesting to 2WT reaping

	USD ha^{-1}		USD ha^{-1}
Additional Income due to change:		Additional Costs due to change:	
Increased yields due to improved timing	none	Equipment hire 7.89 USD hr^{-1} x 8	63
Increased yields due to improved field conditions	none		
Reduced Costs due to change:		Reduced Income due to change:	none
Reduced labor 25 days @ 7.89 USD	197		
Sub-total	197	Sub-total	63

gross marginal change = 197 - 63 = 134 USD

3. Partial Budgets: Switching from no control to a single back pack spray applied herbicide

	USD ha^{-1}		USD ha^{-1}
Additional Income due to change:		Additional Costs due to change:	
Increased yields due to improved timing 2,000 x 20%	120	Equipment hire & labor charge	4
Improved marketability or harvest value		Herbicide costs	14
Reduced future weed burdens			
		Reduced Income due to change:	
Reduced Costs due to change:	none		
Sub-total	120	Sub-total	18

gross marginal change = 120 - 18 = 103 USD

Figure 6 Summary of financial benefits of basic agronomy course to three years of course attendees.

2WT Crop Demo Attendees 2010-2013		USD per ha Value	Sub Totals USD per ha
5,739	Total Numbers of Trainees		
15,151	ha cultivated area based on 2.64 ha average		
65%	Benefit from cultivation*	104	1,022,669
35%	Benefit from harvesting*	134	711,269
53%	Benefit from improved weed control yields*	103	825,209
	Annual benefits to participants USD:		**2,559,148**

* based on comparisons with 4WT; hand harvesting; and no weed control.

Recommendations

There remains a large yield gap between what farmers are achieving and what is possible with readily available technologies, see Chart 1, and good quality extension can have a big impact. In the case of weed control for example farmers frequently reported that herbicides were of poor quality, but on investigation the outstanding problem was misuse of inputs. Farmers responded very readily to training and have generally found that input quality has not in fact been a problem. Sample-level input packages can also aid uptake, and in contrast to larger hand-outs, they stimulate demand rather than undercutting the market: our first crop demonstrations taught weed control without any input package and uptake stood at 53%; the second year we gave backpack sprayers to groups of 12; 9 of the group used the backpack *and* changed their techniques plus 4 non-group farmers i.e. 125% uptake! Herbicides were not given out, so demand was stimulated, benefiting ag retailers who often reported farmers arriving in their stores with information leaflets in order to correctly identify available herbicides. Since the backpack sprayer was also a shared item, more wealthy farmers are likely to buy their own while smaller farmers have access to the requisite technology: so there is a positive impact without negatively affecting the supply chain. The contribution of the shared backpack sprayer from the project was enough for farmers to go and buy herbicides from (also trained) ag-retailers and to open the opportunity to their neighbors.

Extension is expensive because of the remoteness of communities and small land sizes. Farmers still want to see demonstrations in fields as near to their own as possible and to try things out at a small scale, see photos 4 and 6. The private sector has an important role, notably with advice given at retail outlets and so must be trained. But in-field work is less suitable for retailers since the costs are high and benefits more limited for an individual retailer. Also resource-use efficient techniques and integrated management approaches must be developed with farmers and scaled up: this is specialist work and may have a perceivable potential conflict of interest with retailers.

We have seen excellent responsiveness of DAIL extension staff, ag retailers, faculty, and farmers to improved messaging, notably with 1 in 20 crop demonstration participants buying a 2WT; changes to fertilizer placement, timing and rates; and herbicide use with huge benefits to farmers, and with increasing DAIL leadership in implementation.

Photo 6 from top left clockwise: JDA trainer discusses with participants at a field day; a women's cooperative discuss appropriate mechanization at their field location; a certain amount of admin can't be avoided: field day records being taken; farmers watch a day's work completed in an hour – reaping.

Figure 7 Tash Morad training course land owner

Tash morad, left, was the land owner of a demonstration site where a basic agronomy course was taught in 2013. He lives in Gargari, Hazrat Sultan, Samangan. Tash Morad told us: "Before this course I was using fertilizer at heading and not getting a good result. Now I know it is more useful to apply it at tillering. I only ever grew local wheat before this project and had a lot of lodging. This year we grew 18 varieties in the demonstration plot and next year I will be growing Ghori 96."

Appropriate mechanization for 4WTs: improved resource use efficiency

Belarus and more recently smaller four-wheel tractors (4WTs) are used widely in Afghanistan and are contracted by farmers mostly for tillage and threshing services. While we focus much of our work in mechanization on the 2WT which is smaller and better suited in many situations, the 4WT still has an important role, especially in areas with larger land holding or field sizes which are frequently rainfed or semi irrigated.

Photo 7 4WT seeder on rainfed land in Jawzjan, 2013

Currently, 4WTs provide few services and almost always seed is broadcast by hand and then cultivated in with a harrow. Rainfed and semi irrigated land farmers infrequently use improved inputs.

By using seeders farmers can reduce seed rates; economically place seed bed fertilizers; reduce moisture loss at planting; and improve establishment through depth control of seeding.

Activities

The project procured 3 types of seeders in Pakistan for participatory evaluations with farmers. Existing 4WT contractors were surveyed as trainees for the seeders and agronomy courses developed at the location of the contractor and his existing clients. DAP was given to the group to use with the seeder as an incentive to use the seeder, because fertilizer is otherwise not considered economic by these farmers. This allowed the contractor to practice on a significant area of land, and clients to observe first-hand the benefits of the seeder and value of seedbed fertilizer placement when applied

properly. The group met 4 times through the year for training and to evaluate the performance of the seeders. In 6 out of 7 cases the group was considered successful enough to support into the second year; in one case, a new contractor / location was designated. At the end of the second year the groups were given the chance to buy the used seeders. Five took the opportunity, indicating that the seeders had been viewed favorably by the groups.

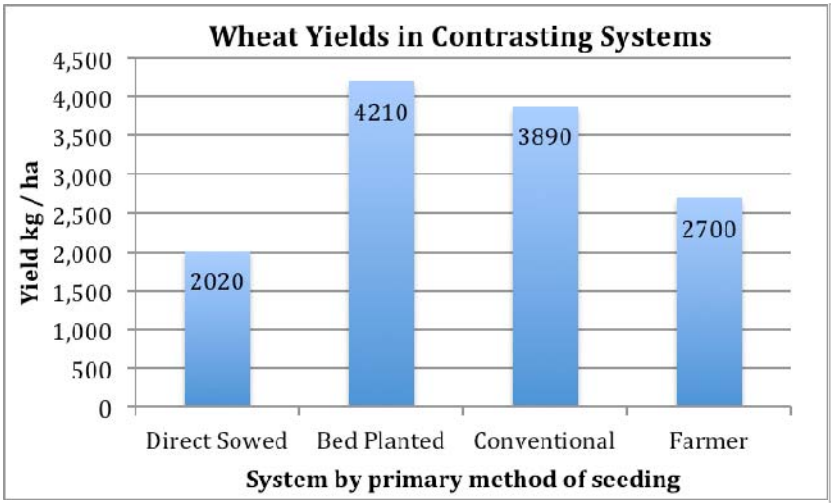
Outputs

Table 3 appropriate mechanization for 4WTs location and participant numbers over two years

Province		Project Year		
		2011/12	2012/13	Combined
Balkh	Districts	2	1	2
	Locations	3	1	3
	Farmers	35	31	41
	Trainee Days	140	124	264
Samangan	Districts	1	1	1
	Locations	1	1	1
	Farmers	36	25	41
	Trainee Days	144	100	244
Jawzjan	Districts	2		2
	Locations	2		2
	Farmers	39		39
	Trainee Days	156		156
Faryab	Districts	1	1	2
	Locations	1	1	2
	Farmers	37	40	77
	Trainee Days	146	120	266
Total	Districts	6	3	7
	Locations	7	3	10
	Farmers	147	96	198
	Trainee Days	586	344	930

Districts included: Balkh: Khulm (2), Dehdadi; Samangan: Aybak; Jawzjan: Khaja Dukoh, FaizAbad; Faryab: Mymana, Khaja Paytakht, Andkhoi

Chart 2 yields averaged from 2 Balkh and 2 Jawzjan villages where 4 4WT systems were compared in 2012



Direct, Bed, and Conventional systems used seeders on uncultivated, bed-formed, or cultivated soils respectively; they also had a JDA fertilizer regime which included an N application in the form of UREA.

The Farmer yield came from near neighbor's and was broadcast and harrowed in according to typical practice.

Farmers used 85 kg ha DAP and 0 UREA;
JDA used 78 kg ha DAP and 125 kg ha UREA.

Figure 8 Partial budget for shift to 4WT seeder use with minor fertilizer practice amendment

Partial Budget: use of improved seeding and fertilizer timing

	USD / ha		USD / ha
Additional Income due to change:		*Additional Costs due to change:*	
Increased yields	394	Increased fertilizer	66.8
		Increased cost of operations	100
Reduced Costs due to change:		*Reduced Income due to change:*	
Reduced seed rates	20	none	
Sub total	414	***Sub total***	167
Gross marginal change:	**247**		

Photo 8 left: bed forming and sowing in one pass, left resulting crop of wheat at heading. Faisabad, Jawzjan, 2011: yields were more than 50% higher than in neighbor's fields.

- 70 ha of land was planted with the 4WT for operator's clients in 2011 and 70 ha in 2012 with project support.
- 5 of the 7 operators bought the seeders, which have capacity to sow a combined 1,000 ha of land per season.

Outcomes

Chart 3 list of 4WT contractors who purchased a seeder during the project

Name	Province	District / Village
Haji Momen	Balkh	Dedadhi Karmalik
Shamsuddin	Balkh	Dawlat Abad Center
Qalich	Faryab	Andkhoi Chakman
Mohammad Rasoul	Samangan	Larghan Center
Ghulam Rasoul	Balkh	Khlum Oljato

Five contractors now own a seeder and are using it in the current (2013/14) cropping year to sow their crops, with a capacity of more than 1,000 ha between them. Our field assessments show that farmers could increase production by 1,190 t and earn an extra 317,000 USD per year.

Challenges / Lessons Learned

Seeders with 4WTs have a number of challenges:

- Farmers do not quickly relate to the benefits since broadcast sowing is not expensive and they have never seen crops in lines and often consider them to be wasting space.
- Hiring 4WTs is expensive, if more than a direct seeding pass is required. Contractors are not used to carrying implements onto land, and two passes or more become more expensive.
- Operating seeders requires a range of skills not currently developed.
- Seeders are most advantageous when combined with reduced tillage, improved weed control, crop rotations, and seedbed fertilizer applications – these are additional components to train and convince farmers of, some of which are expensive to implement or time-consuming to evaluate.
- Uneven ground can result in poor establishment.

Photo 9 farmers inspect a seeder with the contractor

However, seeders open up a new range of possibilities for farmers including:

- Reduced seed rates
- Improved dry planting – extended operational period
- Improved moisture use efficiency
- Highly efficient use of seedbed fertility
- Mechanical inter row weeding options
- Increased speed of operations and reduced costs

Conclusions / Recommendations

Photo 10 trainees gather for on-farm training in Samangan

The rapid uptake of the seeders in this project period represents a big success, and implies further work would be rewarding. Seeders work much better if land is levelled, and are more effective when combined with improved agronomy or conservation agriculture techniques.

Participatory Varietal Selection

Background

Wheat breeders and extension programs have long found that varieties approved in formal systems are not always those favored by farmers. A lack of 'client orientation' has been cited as a problem and ways of understanding and involving farmers more throughout the process are constantly being developed. This enables upstream stakeholders e.g. breeders to better understand farmer needs and perspectives, and downstream users e.g. farmers to play a more active role. At some stages of the seed system the lines between research and extension become very blurred, as learning about new varieties and uptake occurs in the same context. These approaches are an excellent way for seed to enter informal systems where they can rapidly extend from farmer to farmer which is the prevailing way in which self-pollinating seed extends in farming systems world-wide. These approaches also lead to empowerment of farmers, and contrast positively with blanket seed distribution where seed is selected and bought by projects and not necessarily known by farmers or highly valued as seed.

Introduction

In 2010 we surveyed 91 farmers and found that of those growing new varieties only 53% favored them above old or local ones, but most of these farmers could not name the variety they were growing. They had received it in a distribution of some kind, and had not had a chance to evaluate other released varieties to find something preferable.

Additionally questions remain about the suitability of released varieties especially in marginal environments. The prevalence of Zardonna, an old variety grown across northern Afghanistan, is one indication that more recent work in formal systems has not been very successful, and old or local varieties in the semi irrigated areas of Balkh and Jawzjan in particular are a further hint that marginal areas are for some reason not benefiting from seed system development.

The prevailing mechanism by which farmers have accessed new seed in recent years has been through distributions where they have had no say in the variety they receive. Distributions are carried at such a scale that seed prices are fixed and far higher than farmers can afford. And with aid or development projects being the clients, quality assurance has been a problem.

For these reasons JDA has focused on enabling farmers to try out new seed, and evaluate a range of available varieties in their systems, both to genuinely assess its value, but also to empower farmers and give them a chance to select according to their own criteria.

Activities

We began variety evaluation work with 'mother trials' at the agronomy course locations and by giving 9 or 10 farmers from the 100 a sample of a new variety. All participants assessed at the field days, and the 9 or 10 could present their findings to the group.

Following a very positive response to this approach, and having smaller agronomy course groups in the final year, we gave samples to all participants. We also established stand-alone Participatory Varietal Selection course sites, focusing on variety assessment and training DAIL extension workers to take leadership. Again, responses were very positive.

Figure 9 concise training guide: Participatory Varietal Selection

Pre-Visits

Establishing the relevance of the activity for a particular location including prevailing varieties, interest of local leaders, willingness to commit to our requirements in terms of village representation.

Training Session 1

Developing a Varietal Specification

The group is introduced to the exercise and develops a specification of which characteristics are important, and what problems they have with their varieties. This is recorded, along with land areas and varieties grown. Decide on a mother trial location, give farmers a new sample of 7 kg, decide together on when it is good to meet for field session 2 in order to evaluate the performance of varieties against the varietal specification.

Training Session 2

Establishment Assessment

The group reports in turn on how their varieties are performing against the specification they developed in session 1. Records may be kept of which is better for each characteristics – the new variety or their existing variety. Farmers are asked if they remember the names and reminded about the varieties they are growing. Assessments may be taken at the mother trial site.

Training Session 3

Heading and Plant Scoring / Voting

Again relevant assessment against varietal specification, both individually for each group member's baby trial, and together looking at the mother trial site. There may be paper voting, or by standing next to favourite plots. Count these and have farmers discuss why they like the variety best Give farmers the names of each variety at the mother trial site.

Training Session 4

Final Evaluation and Review

Come together after data has been analyzed. Ask farmers if they plan to grow the variety next year. They may have yield data for baby trials. Often farmers trade seed at this point. Sometimes farmers may receive additional seed of favorite varieties identified from the project if the project has seed available.

Figure 10 from top left clockwise: farmers in Samangan study wheat varieties at a mother trial; tables of locations and attendee numbers in varietal evaluation activities ; farmers take a close look at the wheat flower; farmers and extension agents comment and select wheat in segregating populations.

In 2011/12 9 to 10 participants of each basic agronomy course received samples and mother trials were planted at crop demo sites.

Province	Districts	Locations	Participants total
Balkh	8	8	73
Faryab	8	8	74
Jawzjan	6	6	55
Samangan	3	3	28
SarePul	3	3	36
Totals	28	28	266

In 2012/13 all basic agronomy courses were smaller and all participants received samples:

Province	Districts	Locations	Participants total
Balkh	5	5	197
Faryab	5	5	176
Jawzjan	3	3	93
Samangan	3	3	107
SarePul	2	2	65
Totals	18	18	638

Also in 2012/13 additional, independent, PVS focused locations / courses were implemented with emphasis on DAIL training and leadership: 12 DAIL extension implemented:

Province	Districts	Locations	Participants total
Balkh	3	5	165
Faryab	3	3	102
Jawzjan	3	3	114
Samangan	3	5	160
SarePul	2	3	105
Totals	14	19	646

Outcomes

- 80% of farmers, or 1,240, plan to grow the seed again next year
- 372 farmers gave some of their seed to at least one neighbour
- Yield potential increased for new adopting farmers from 26 % to 205 % better than with local varieties depending on irrigation availability, see chart 4, below.
- Conservative estimate of increased production potential 419 t or 124,736 USD
- Empowerment through evaluation procedure and increased understanding of available varieties, farmers showing strong preferences for Ghori 96 and Lalmi 2, see chart 5.
- Increased diversity in varieties used improves the resilience of wheat production systems.
- 11 DAIL extension staff implementing 12 sites with minimal oversight.

Chart 4 yields of 'New', 'Old', and 'Local' wheat varieties grown at 26 mother trial locations in 5 provinces of northern Afghanistan. Data is grouped for the number of irrigations received at each site.

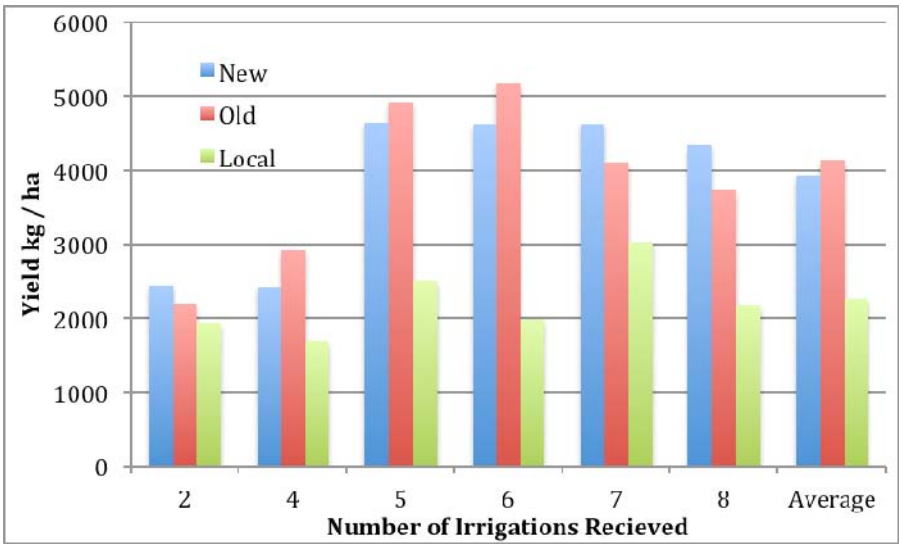
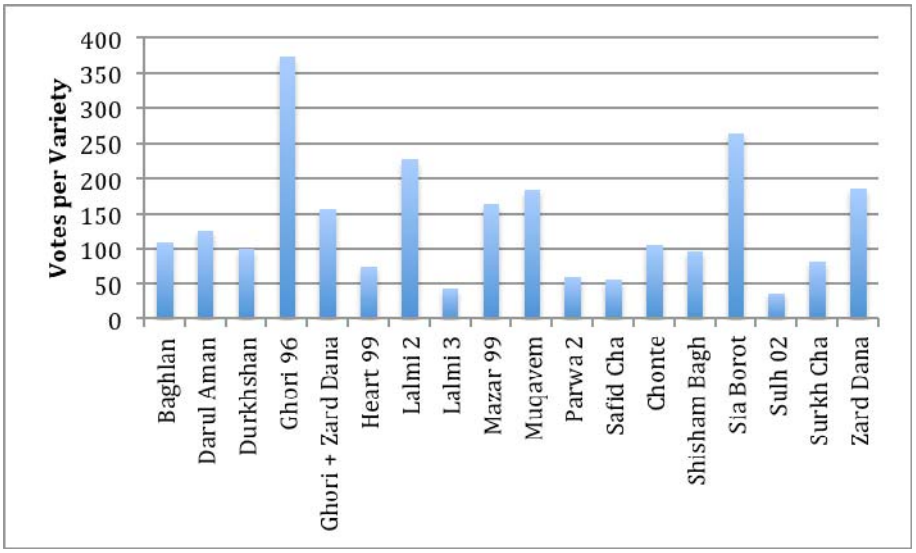


Chart 5 results of farmers voting for varieties grown side by side at 20 demonstration sites in northern Afghanistan, 2013. 492 farmers cast 5 votes each, old, local, and recommended varieties were included.



Discussion

New varieties at mother sites performed much better than local varieties, see chart 4, and uptake was very positive. The impact is multiplied by farmers further giving to neighbors from their harvest, particularly from mother trials sites, but also from baby trials.

Local varieties still received large numbers of votes: such as local variety 'Sia Borot', see chart 5, which is reflective of farmers choosing to grow these even after exposure to new varieties. The implication being that new varieties are not reflecting all of the characteristics that are important to farmers and that yield alone is not enough.

Large scale seed distributions in recent years have led many to believe that this is a fundamental role of projects and government, yet much of this seed is poor quality, re-sold, eaten, or not suited to the system. When receiving a small sample both extension worker and farmer at first questioned the value, but by the end of the first field day they had become very interested and at the end of the program were proud to have studied the range of varieties.

We used large sample sizes of 7kg. This is enough that when performing well farmers have enough seed for most of their planting in the second year. This is probably a suitable amount for rapid uptake potential of released varieties. When less certain or pre-released varieties are being used much smaller samples can be given out. Farmers collect or exchange seed in quantities as little as a few grams, even for wheat.

Conclusions / Recommendations

In the course of this work we heard many stories of farmer developed varieties and seed exchange mechanisms operating with great effect. Interacting with engaged farmers at more advanced levels is clearly an option with scope for the development of new village based seed enterprises or improved marketing, thus potentially feeding farmer's varieties back into breeding programs for genetic enhancement.

This style of variety evaluation allows farmers to select from available seed for their diverse systems. They can be managed by DAIL extension workers and support demand-led development, which can rapidly lead to uptake of new, appropriate varieties while at the same time feeding back information to extension and research departments on varieties preferable in different environments. This also provides a check on the performance of seed companies.

2WT Sales and Training

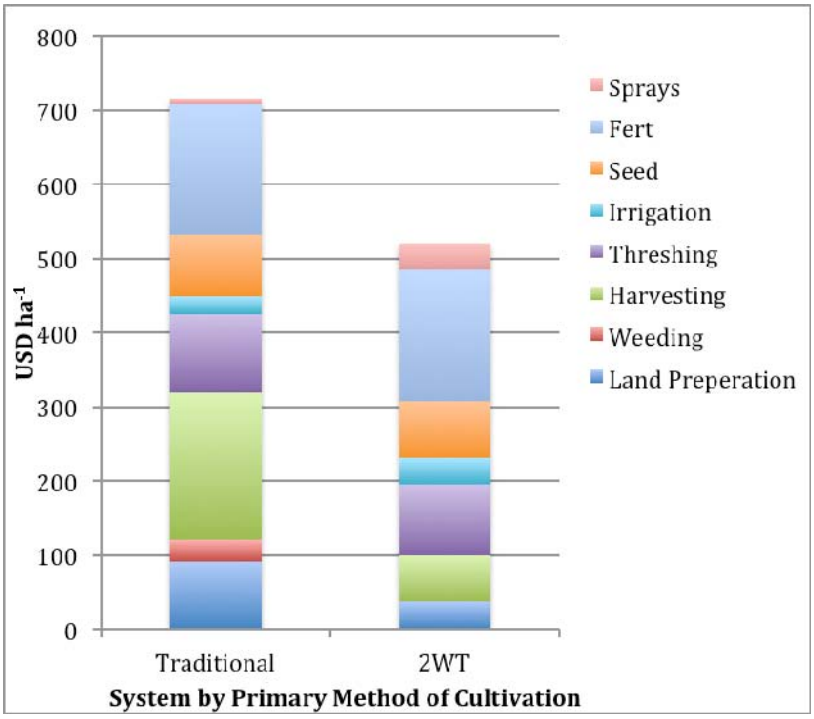
Background

JDA started working with 2WTs in 2004 under DFIDs RALF project. Until that time Afghanistan was served by manual, draft, and Belarus four-wheel tractor (4WT) power. Manual and draft power are highly burdensome and their expense and low productivity of labor place a major limitation on development. The Russian style Belarus four-wheel tractor, conversely, is overpowered and too large for small fields, and contracts with multiple farmers are almost always at sub-optimal times with farmers having to wait for the contractor when their land is ready to till or sow. The larger 4WTs are expensive, damage fragile soil structures, and offer little more than tillage and threshing options. 2WTs by contrast are cheaper, highly versatile, and well suited to land sizes and environments in much of Afghanistan.

Introduction

Low yields and high costs of production are major problems for many Afghan farmers. Land preparation and harvesting constitute nearly 40% of variable costs. 2WTs reduce these by 70% and the overall variable costs by 30%, see chart 6. Land preparation is improved by creating a better soil tilth and improved timeliness of operations resulting in lower seed rates and higher yields.

Chart 6 variable costs for a typical northern Afghanistan farm using a large tractor compared to one using a 2WT.



We developed an approach to 2WT extension with the aim of achieving a start to sustainable mechanization in selected project provinces and districts. We considered a number of points key to this including: 1) farmers should be able to properly evaluate the equipment before deciding to buy it 2) buyers needed to receive adequate training and support in order to be successful with equipment 3) farmers should be able to own equipment within a social context that encouraged it to thrive 4) the private sector needed support to develop profitable opportunities from the 2WT economy, and in order to develop a spare parts and repairs and services supply chain, and 5) farmers should pay a genuine contribution reflecting their perception that the 2WT is a valuable asset.

Activities

Basic agronomy and appropriate mechanization courses are an important introduction to 2WTs, developing consensus about the value of the equipment and feeding farmers into the sales and training part of the project. Adopters gain confidence that their neighbors have also seen the results at the basic agronomy courses and will therefore be clients.

Farmers paid 50% of the retail price for the basic unit or reaper, and 35% for the seeder. Trailers can be made in country and are in demand from new 2WT owners: a number of local workshops are making implements for 2WTs in their communities.

New owners were given a 5 day intensive training, see figure 11 below, and were visited twice in the following 12 months for top up training.

Figure 11 concise training guide for new 2WT owners

Assembly, Operation, Maintenance, Safety and Business Development for new 2WT Owners.

Day 1: Assembly

Show and discuss video, practical assembly.

Day 2: Maintenance

Show and discuss video. AM: clutch, chain tension, diesel filter, oil and air filter. PM: Oiling and lubricating 2WT and attachments.

Day 3: Safety

AM: class-based presentation introduction to engine. PM: starting, back pressure, V belt, driving and operation on slopes, entering / exiting fields.

Day 4: Field Operations

AM: Rotation and land preparation, blade tillage mountain options, seeder and calibration.
PM: seeding, depth control locking and opening.

Day 5: AM: Trailer, Reaper, and Other Attachment Operation / Introduction

Discussing use, hitch options, heavy load operation, and breaking / safety issues. PM: Spring bear and cutting blade adjusting. Belt adjusting, oiling, greasing, threshing. Water pump and rice mill demonstration.

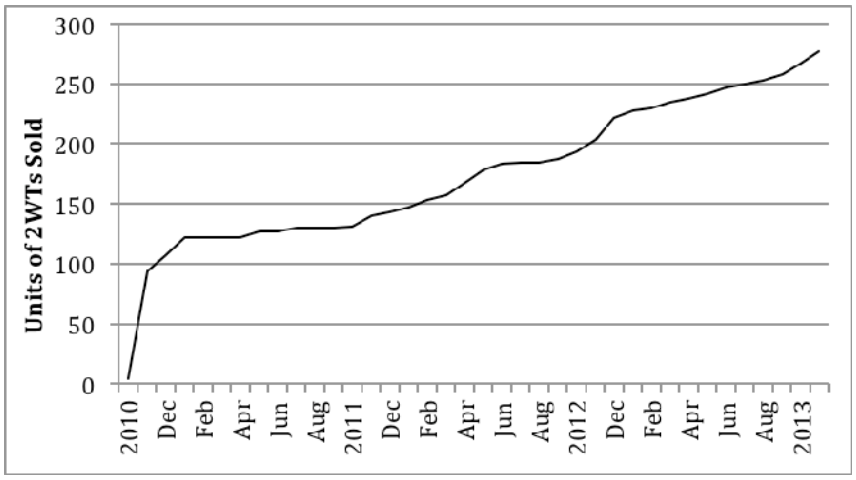
Day 5: PM: Business Development

Discuss development of client base, pricing, and depreciation. Introduce record keeping notebook.

Photo 11 New tractor owner receiving training in Balkh

Challenges / Lessons Learned

Chart 7 graph of accumulating sales of 2WT basic units over the project period.



The IDEA NEW unit sales targets were initially much higher. But after this project was designed and agreed on, a second USAID project, AVIPA, began selling 2WTs at prices below their salvage value in the project area. Naturally, IDEA NEW project sales numbers basically dried up – note Feb-Aug 2011 period in chart 7. Before the AVIPA activities began, in the first 4 months of the IDEA NEW project, we facilitated 122 2WT sales and only opened the opportunity to a small part of our project area. But over the next 9 months when the AVIPA project was underway, only 9 units were sold. Since then, sales have been steady at an average of nearly 6 per month.

The AVIPA work had a negative impact on the perception of 2WTs in several ways. Many tractors sold were improperly set up and without good training. Farmers were not able to get good use from the tractors and quickly felt it was a useless item – a message that spread in some areas. Models of 2WTs were imported which were not compatible with the existing spare parts supply chain and with sub-optimal quality.

JDA planned and implemented follow up trainings for AVIPA tractor owners. In many cases we found 2WTs without water or oil, cultivating tines attached back to front, and other fittings and fixtures incorrectly placed. These owners quickly went from describing their 2WTs as useless to realizing how useful they could be. The vast majority of 2WTs in northern Afghanistan are now operating profitably and demand for IDEA NEW tractors is steady.

Outputs

Table 4 2WT sales per province

Province	# Districts	Project Facilitated Unit Sales: 2WTs	Reapers	Seeders
Balkh	8	150	8	2
Faryab	8	16	6	
Jawzjan	7	95	14	
Samangan	2	9	3	
Sare Pul	3	7	2	
Total	**28**	**277**	**33**	**2**

277 2WTs, 33 reapers and 2 seeders were sold in the project period across more than 28 districts, see table 4. Each farmer received 5 days training in operation, maintenance, safety and business development at the beginning and 2 follow up visits in the field. The basic agronomy and other courses are utilised to help introduce farmers to 2WTs but they also deliver a more ready client base for adopters, facilitating more rapid business development for new owners. Many of these operators have plans to develop their operations with the purchase of additional implements in the future.

Outcomes

A single 2WT can cultivate more than 30 ha of land in a single season depending on the environment, and may serve 6-7+ farmers for cultivating services. Responses from agronomy course participants indicate that each tractor is cultivating 35 ha per year since many operate in two seasons.

Benefits include:

Revenues for operators; reduced costs for clients; improved seedbed preparation, timeliness, and yields, and much increased productivity of labor.

Figure 12 Mohammad Yusof was advised to start contracting with his 2WT and never looked back

A typical land holding of 4 ha takes 20 days to cultivate with oxen, which is a full season's work and only enough to sustain a family; most 2WT operators become small contractors earning money.

Mohammad Yusof from Shortapa, Balkh, left, only cultivated his own land until one of our trainers convinced him to start contracting for his neighbors. He agreed and provided tillage services to 13 farmers and 7 ha in the first season with his 2WT.

Conclusions and Recommendations

The 2WT is very different to using oxen or 4WTs, and very few farmers are sure about its benefits until they have seen a full season of use; most need to see it operate for several years. Kaldar, where JDA begun work with 2WTs in 2004 bought most 2WTs under this project, and is now almost entirely powered by 2WTs. Each day we have farmers coming to us describing how their minds have changed after watching their neighbors use a 2WT for a couple of seasons. One farmer from Sholgara, Balkh, recently bought a tractor and said:

"I laughed at my neighbor when he bought a 2WT in 2010. I said, "so what's suddenly wrong with my oxen after using it since my great grandfather?" After the first harvest I watched more quietly, and after the third I was fed up with getting lower yields. I've been using his this year and am now buying my own, and my sons will thank me that they are not feeding it early in the morning."

Currently, risks in the development of 2WTs include the limited supply chain which is provided in the north by one company, although two others are involved. A lack of competition in spares supply is reflected in high prices and the volume of sales is still quite modest: not a compelling business activity for large companies.

For farmers who could benefit from the 2WT, gathering the cash to invest in it is challenging – while a cost analysis of oxen reveals that they are extremely expensive, the non-cash nature of these and costs spread over time make oxen feasible for farmers despite being highly burdensome. The benefits of 2WTs as a pre-cursor to development and release from drudgery justify their subsidization in this context.

Select active workshops should be supported to improve their capacity to innovate and provide implements for 2WTs. The IDEA NEW program did however, establish 25 workshops and parts sales shops. These shops were subsidized until September 2011. Afterwards, many closed their doors due to lack of business.

Specialized small group training sessions

Introduction

As the project period progressed, we began to identify: 1) key interventions which had high benefit to cost ratios, 2) the need for repeat and specific training on individual aspects and 3) access to key inputs so that farmers could move from general appreciation of improved agronomy to real change in their fields. Two options for small group trainings were weed control and advanced operator training with 2WTs.

1. Weed Control Small Group Trainings

Introduction

Weeds are a major limiting factor to increasing yields in northern Afghanistan. In some locations it is difficult to identify the intended crop such is the level of infestation. A crude estimate for wheat yield losses in northern Afghanistan is around 30%. A survey of grass weeds and their impact in northern Afghanistan undertaken by the project in 2011 showed average of 20 grass weeds per m^2 in farmers' fields, which alone was accounting for 180 kg per ha of lost yield, see chart 8. Indeed JDA found in the 2011 harvest year a single timely spray of either a broadleaf or grass weed type herbicide, available locally could result in a 30% yield gain.

Weed control methods implemented over time have cumulative beneficial effects as the weed burden in the soil seed bank can be reduced, integrated approaches are preferable, reducing reliance on the market, and the human and agro ecological risks associated with herbicides.

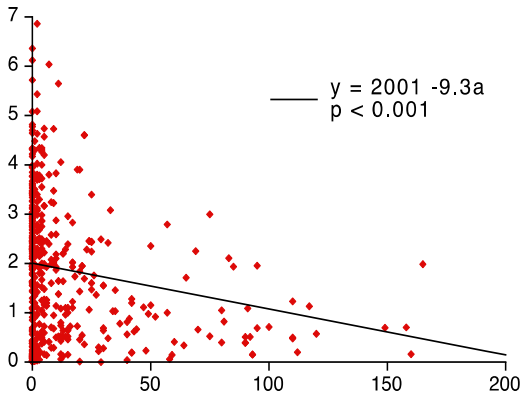
Farmers have a range of techniques for reducing weed competition including late sowing, high seed rates, and hand weeding. Herbicides have also been used in recent years, but retailers, extension actors, and farmers have had a limited understanding of what should be used, or how to use herbicides effectively. One common mistake for example is to spray very late in the season, but neither is it unheard of for a retailer to sell the completely wrong herbicide.

Land tenure is also a challenge to improved weed management since the burden of responsibility lies with the tenant, but the year over year benefits are reaped by the land owner. However, JDA has seen a very high degree of responsiveness to weed control trainings, probably because farmers have not realized how simply and inexpensively weeds can be controlled.

While weed control was a part of our basic agronomy throughout the project, it was the 2011 study that illuminated just how big a problem weeds are that led to a 2012 pilot of weed control training in a specialist course, and the success of that lead to scaling up in 2013.

Chart 8 wheat yield response to grass weeds

Plot and regression line of wheat grain yield vs grass weed heads per m^2 from 435 quadrats and 64 fields including demonstrations and farmers own management.



Activities

JDA delivered a basic weed control training during IDEA NEW projects from 2010-2013 to more than 7,740 farmers:

2010/11 5 provinces, 29 districts, 3,127 farmers

2011/12 5 provinces, 29 districts, 2,680 farmers

2012/13 5 provinces, 25 districts, 1,933 farmers

Photo 12 Ali Mohamad delivering an out-of-season training using plants prepared in a greenhouse: preparing farmers to control weeds before their crops reach this stage.

Photo 13 JDA trainer delivering specialized weed control training in Saripul, Suzma Qala 2013

Following the 2011 study of weed impact on wheat yields across the northern 5 provinces we found that a) the problem had been understated, and b) that simple improvements in management can have a big impact. JDA invested more in this area by: 1. finding a solution to the un-availability of herbicide nozzles for backpack sprayers, and 2. piloting a more intensive, specialized integrated weed control training for small groups in 2012.

During 2012, 29 groups totalling 350 farmers were trained in a 3-day participatory training with each group receiving a backpack sprayer. Between these farmers 1,050 ha of land was being cultivated each year. Follow up on this training revealed its notable success and more stand-alone weed control trainings were delivered and inserted into our other agronomy trainings.

In 2012 we also conducted a workshop for faculty from Balkh University Faculty of Agriculture on integrated weed control. The workshop was at their request and attended by 7 faculty members. It was designed to introduce literature and subject matter that could be utilized in existing curriculum at the university, see photo 14. Similar trainings were given to faculty and students at Samangan University.

Photo 14 field workshop with 7 Balkh University Faculty of agriculture teachers.

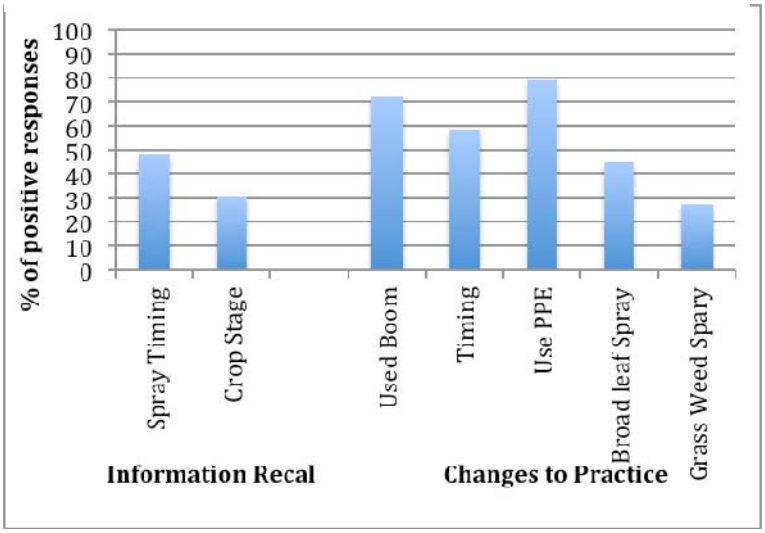
In 2013 specialized weed control trainings were held as stand-alone trainings, and inserted into our other agronomy courses:

- 62 Weed Control Specialist Trainings: 762 participants
- 38 Weed Control Trainings as part of a wider course: 1,171participants
- 32 Ag Retailers trained
- 35 Backpack sprayers bought by farmers or ag retailers
- 5 Backpack sprayers donated to 2 universities, and integrated weed control trainings given
- A 1-day workshop with farmers, input dealers, and extension agents discussing the problems of weeds and possible solutions

We also placed 30 backpack sprayers in 5 ag retailers to stimulate private sector interest in stocking improved, specialist equipment, and to monitor the effectiveness of our work in increasing demand in the private sector.

Outcomes

Chart 9 participants were asked about the impact of weed control trainings on their practice; and information recall.



A survey of the use of the backpack sprayers was conducted in the season following training. Nine group leaders were interviewed and 29 individual farmers. Three group leaders from each of Balkh, Jawzjan and Samangan were selected at random, and three members of these groups as individual representatives.

Group leaders had been trained to collect records of the sprayers use as a management and monitoring technique and as the point person, responsible to check sprayer condition and give to users, and train any non-group users of the sprayers: they have good knowledge of the sprayer's use.

Findings

Findings from group leader surveys suggested that 9 in each of the 12 group members used the sprayer, but also that in addition 6 or 7 non-group farmers used the sprayer. We also heard several stories of farmers giving the full training to others in their community. Individual interviews revealed a similar picture with 9 or 10 in 12 having used the sprayer. Group leaders' log books and recall suggested that 0.69 ha per attendee was sprayed, individual interviews estimated the figure a little higher, at more than 1 ha per adopter, or 0.8 ha per attendee. Table 5 summarizes some of the findings from group leaders' records.

Table 5 summary of group leaders records regarding sprayer use. JDA weed control trainings, northern Afghanistan, 2013. 5 jerbis = 1 ha

Name/Group Leader	Province	District	Village	Jeribs Controlled for Weeds	Jeribs Sprayed for Other Purposes	Total Jeribs Sprayed	#Farmers that Used the Sprayer
abibullah	Balkh	Dehdadi	Negari	24	13	37	8
Nabi Jan	Balkh	Sholgara	Qadim	42	4	46	13
Abdul Satar	Balkh	Balkh	Uf Malik	21	2	23	7
Mohd. Dawod	Samangan	Hazrat Sultan	Ghaznigak	50	6	56	17
Fazel	Samangan	Center	Hasan Khil	40	5	45	15
Haji Qadir	Samangan	Center	Khoja Ismail	32	6	38	24
Abdul Baseer	Jawz Jan	Center	Qara Kent	32	16	48	11
Ab Shokor	Jawz Jan	Center	Hassan Abad	30		30	4
Hiatullah	Jawz Jan	Faiz Abad	Sansiz	100	200	300	40
			Grand Total	371	252	623	139
		Average Per Group		41	28	69	15

We also found that (see chart 9):

- Every farmer using the new sprayer, also used the specialist new boom and nozzles
- Every farmer using the sprayer could identify a change that they brought to their weed control approach from last year
- 62% of farmers interviewed could recall at least one learning point from the training
- More people than we trained used the sprayer (because of non-group farmers)

We estimate that farmers spraying correctly for the first time are increasing their yields by more than 20% which is 114 USD for a typical farmer growing 1 ha of wheat.

Ag Retailer Follow Up

One ag retailer in each of the 5 northern provinces was invited to buy sprayers at a wholesale price. Limited supplies were available and retailers recognizing the quality wanted more than we could supply. On follow up with the Balkh retailer they reported that every sprayer was sold quickly to farmers who had previous knowledge of the model of sprayer. Since this is unique in the market place at the moment, it is clear that this is a direct link created by JDA field training. Samangan, Jawzjan, Sare Pul, and Faryab retailers each reported similarly.

Economic impact of 2012 and 2013 trainings

Table 6 summary of physical and financial impact of 2013 weed control trainings

2,283	Farmers Trained
1,712	ha brought under improved control
400	kg / ha increased yields
684,900	kg increased production
286	USD / t price of wheat
195,881	USD value of increased production

Conclusions

Photo 15 small group receiving backpack sprayer training

While JDA trainings are given within a framework of integrated weed control, at the heart of the major impact is correct herbicide use. This provides an excellent start to addressing weed problems in wheat. However, for resilient and sustainable agricultural production, farmers will develop a suite of techniques for all their crops not just limited to spraying when viable. Even within the area of spraying in wheat, our major successes have been relatively narrow, being mainly limited to use of selective broadleaf and grass weed type sprays. There remain unanswered challenges which will become important targets for continued yield gains as the knowledge from these trainings extends over the

coming years, including agro-ecological aspects, and those of policy and quality control. These lesser understood or unmet challenges, e.g. weeds in other crops, sedge, annual rye in wheat, need to be the subject of adaptive and applied research and investigation, so that we will be ready to tackle the issues in the future.

Delivery of participatory trainings in weed control across the value chain, including within educational institutions is returning excellent value to project expenditure and should be supported over the next few years as a core part of any effort to increase production. It is important to note that other techniques for improving crop production, such as reduced seed rates, or increased early nitrogen, can increase weed problems. Hence improved weed control should be considered a pre-cursor or at least key co-technology in agricultural development.

2. Specialist Short Courses: Advanced 2WT Operation and Follow up

Introduction

Courses for 2WT owners were conceived in response to multiple tractors not being used by AVIPA project participants who had not been properly trained. In order to keep unit costs low and have the biggest impact by training larger groups, we prioritized locations where multiple units could be found.

Activities

Training was offered for up to 3 days, less when the group was more advanced or smaller, based on the 2WT training course described in figure 11. Each participant was given basic supplies to conduct a service, which was carried out as part of the course.

Outputs

Table 7 training of AVIPA 2WT owners between October 2012 and May 2013

	Districts	Courses	Participants	Trainee Days
Balkh	4	4	29	75
Samangan	3	6	29	84
Jawzjan	4	6	39	97
Sare Pul	2	4	17	21
Faryab	2	3	25	50
Total	15	23	139	327

Outcomes

A number of tractors with problems were repaired and questions or problems from owners about operation and maintenance were answered. Owners were very appreciative of the training and had a renewed enthusiasm to put their 2WTs to economic use.

Photo 16 2WT owner being shown how to repair their tractor in a specialist training session.

Challenges and Lessons Learned

It is clear that the combination of below-salvage-value-price-point in the AVIPA project and the lack of proper training resulted in health and safety risks, and many miss- or unused 2WTs. Where JDA was working, these expert follow ups gave many of these units a second chance, and they are now put to good use. We had many examples of farmers saying the tractor did not work or wanting to sell it but after this session, the same farmers said that they would not sell it for any amount because it is so useful. Others who had been using their tractors improperly were saying:

'When I bought this I really didn't know if it would be any good and I haven't looked after it properly. If I could start again I'd maintain it and get much better use from it.'

We asked some of these owners if they would replace the 2WT at full value when they need to, and 100% of IDEA NEW participants said that they would; a very common response was:

'Well we won't return to oxen'

Conclusions / Recommendations

Since the AVIPA project was country wide there is probably scope to follow up in many parts of the country with training and put to use multiple units which are currently not being used or defunct.

Photo 17 from top left clockwise. Group of 2WT owners receive training in use of seeder in Faryab; new owner receiving training; one on one operation training for a new 2WT owner in Balkh; group of 2WT owners receiving training in maintenance; never trust a clean agriculturalist! 2WT owner receiving maintenance help; advanced operation training: bed forming with a 2WT.

Hub Locations

Introduction

Photo 18 Extension agents from across the project area visiting a hub location site.

Hub locations provide safe and consistent locations where all kinds of stakeholders can see examples of project activities, meet, input, and exchange ideas. This is very useful for government departments and donors, as well as university faculty and students and farmers alike. Hubs serve for operator training, agronomy training, and higher level input of farmers in participatory research.

In this project hub locations included rainfed sites in 5 provinces, and irrigated sites in Balkh and Faryab, where university land was included to increase impact, i.e. students were involved in hub activities.

Activities

- Balkh University Faculty of Agriculture (BUFA) interns
- Faryab interns
- Ha of trial sites: two excerpts from trial papers are included in outputs below.

Outputs

1. Preliminary report, rainfed trial data 2013 harvest

Full report available from JDA

- Variety trials. One in each of Balkh, Jawzjan, and Samangan.
- Farmer Evaluations. Two courses in Balkh, one in Samangan, farmers growing samples in their own systems.

Introduction

Much progress has been made in the development of the formal seed system in Afghanistan, including screening of material brought in, release, seed production and distribution for irrigated environments. The vulnerabilities and risks in the formal system are not discussed in detail here, but it has been heavily supported by development projects, and has not been oriented towards marginal environments where old or local varieties continue to dominate. The work presented here is oriented towards rainfed environments, and while it should support the release of material through the formal sector, we promote a highly client (farmer) centric approach and suggest that the importance of the informal seed system is probably under-estimated, and that enhancing it is a sustainable approach to agricultural development. Our integrated work is designed to enhance local seed systems which are important and resilient but also contribute to the formal sector.

Photo 19 laying out an on farm variety trial

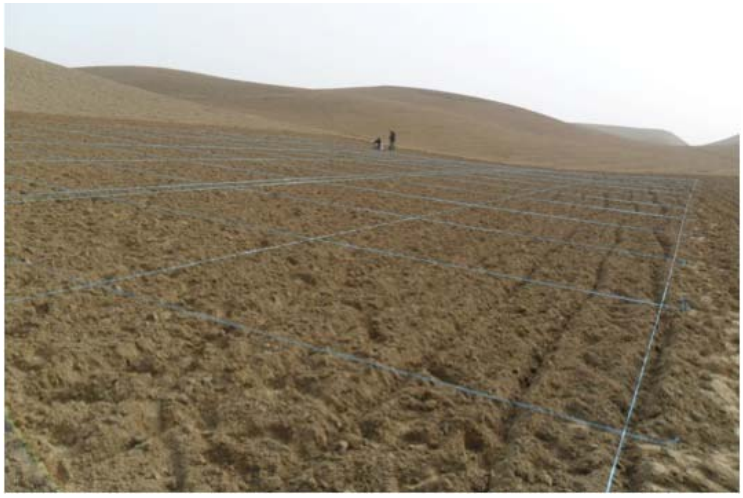
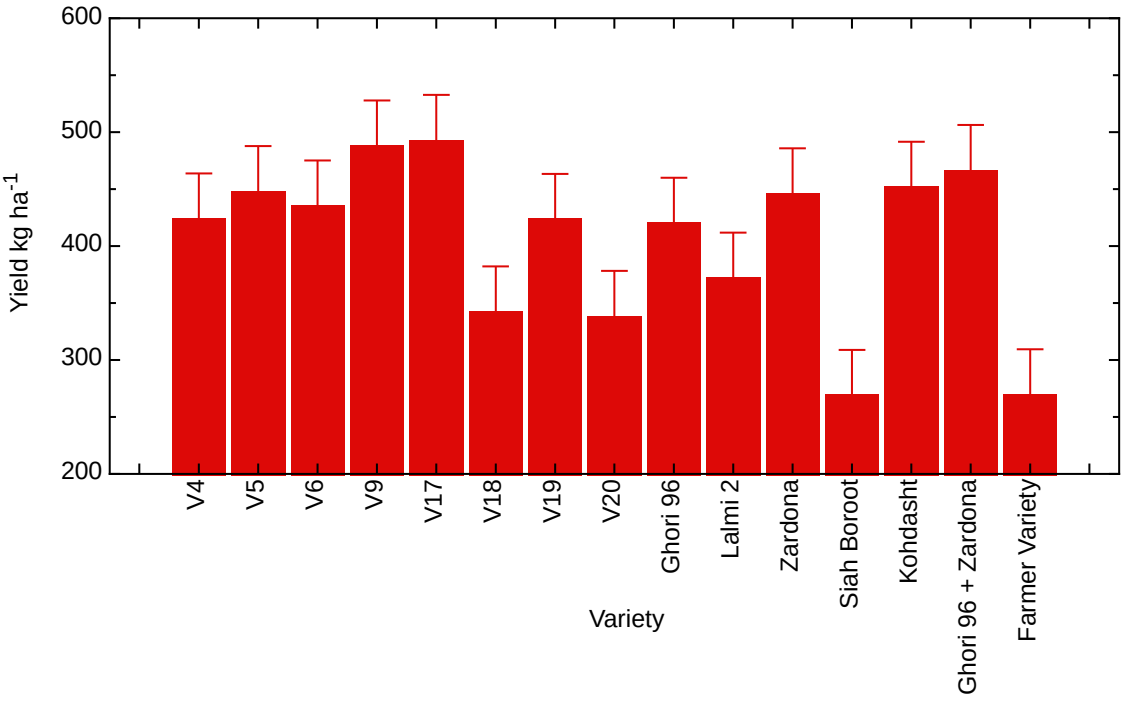


Chart 10 3 sites: Jawzjan; Balkh; Samangan, all in target environments. 3 complete blocks at each. Error bars SED. Harvest year 2013. JDA, northern Afghanistan



Discussion / Conclusions

The two farmer varieties performed less well than recommended varieties on a yield basis; and pre-released material offers a significant gain on these. However, while Zardonna is widely grown in rainfed areas Ghori 96 and Lalmi 2 have not been consistently grown in the northern 5 provinces. The yield advantages of the pre-released material offer an exciting potential contribution to rainfed farming systems, and may lead to greater adoption; but it may be that formal release and the distributions of the style that have been used in recent times will not be the most effective route to extension or adoption. JDA suggest that V9 is ready for fast tracking in farmer trials along with V17 in small sample sizes, and that farmers' perceptions and adoption rates in alternative extension programs should be monitored.

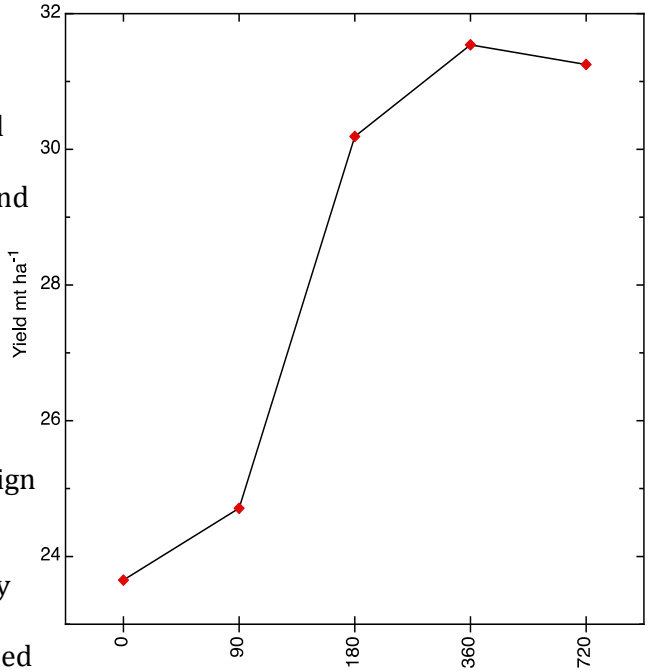
2. Testing phosphate regimes in planting holes for watermelon in Balkh, Afghanistan: are farmer's practices costing them money?

Full report available from JDA

Summary

Farmers commonly apply very large amounts of DAP and manure at great expense to high value crops including watermelon. In a complete randomized block trial conducted in 2011, with 3 blocks and all combinations of 5 DAP and 4 manure rates, we found yields to be highly responsive to 20 g of DAP per station but not to manure, probably because of miss-sold poor quality material. Farmers applying 40 g per planting station may be losing more than 870 USD per ha in costs and opportunity costs, and more when benign manure costs are included. We concluded that a lack of quality assurance and variation in input quality means that blanket recommendations cannot be established. It is recommended that the Balkh University Faculty of Agriculture soil lab, run jointly with the Ministry of Agriculture, is equipped to develop input testing protocols for use by extension services and farmers. Potential models will need to be tested on farm and should include a range of low, medium and high input regimes with inputs currently available through established suppliers. Other soil interactions such as high pH or poor irrigation practice may contribute to utilization inefficiencies and this area deserves further work.

Chart 11 Yield response to DAP applied before sowing to planting holes for watermelon at 0, 165, 330, 660, and 1,320 kg / ha by JDA in Balkh, Afghanistan, in 2011.



Outcomes

Hub locations have enabled project meetings and interchange and facilitated training. Outputs from adaptive research are used in training content and influence the agendas and work of other organizations. We expect to see new rainfed varieties released using supported data from this work.

Photo 20 Agricultural Research Institute of Afghanistan staff member, Naquib, carries out assessments with IDEA NEW project staff member at a hub location.

Strengthening Balkh University Soil Lab

Introduction

BUFA soil analytical lab was set up toward the end of USAIDs AWATT project. It is the only soil analytical facility in northern Afghanistan and one of 4 active labs in the country. It is being increasingly used by a range of stakeholders in research, development, and the private sector. More still needs to be done in order for it to become a sustainably run facility and USAID's IWMP project is looking into taking on this work.

Activities

- Soil analysis for project sites and others
- Training of government and NGO extension staff in sampling and soil science
- Training of BUFA staff in management and soils analytical procedures
- Training of DAIL soil science staff
- Training of BUFA staff and students in the role and use of soil analytical lab

Photo 21 Lab manager and BUFA technician (from left) discuss analytical practice with students in soil lab.

Outputs

- 275 samples from 8 provinces and 46 districts have been analyzed.
- Over 8,900 trainee hours of courses have been delivered, including more than 700 to government employees.
- Production of a lab brochure advertising facility use for third parties.

Figure 13 soil samples analyzed with project support: location by province

Province	# Districts	# Samples
Balkh	13	124
Faryab	9	75
Heart	1	1
Jawzjan	5	19
Kunduz	3	7
Samangan	6	30
Suripul	3	7
Takhar	6	10
TOTAL	46	275

Figure 14 list of soil related courses supported by IDEA NEW soil lab manager

Date	Location	Catogory	Number	Contact Hours	Course title	Content
6/9/2011-20/10/11	BUFA	Students	23	36	Soil Analytical training Course	sampling, profile, CaCO3%, NPK, pH, EC, SOM, texture and structure of soil
23/10/11-05/12/11	BUFA	Students	24	36	Soil Analytical training Course	sampling, profile, CaCO3%, NPK, pH, EC, SOM, texture and structure of soil
16/01/12-29/02/12	BUFA	Students	26	36	Soil Analytical training Course	sampling, profile, CaCO3%, NPK, pH, EC, SOM, texture and structure of soil
04/03/12-18/04/12	BUFA	Students	23	36	Soil Analytical training Course	sampling, profile, CaCO3%, NPK, pH, EC, SOM, texture and structure of soil
20/04/12-15/06/12	BUFA	Students	24	36	Soil Analytical training Course	sampling, profile, CaCO3%, NPK, pH, EC, SOM, texture and structure of soil
20/08/12-14/10/12	BUFA	Students	26	36	Soil Analytical training Course	sampling, profile, CaCO3%, NPK, pH, EC, SOM, texture and structure of soil
15/10/12-10/12/12	BUFA	Students	19	36	Soil Analytical training Course	sampling, profile, CaCO3%, NPK, pH, EC, SOM, texture and structure of soil
14/01/13-11/03/13	BUFA	Students	19	36	Soil Analytical training Course	sampling, profile, CaCO3%, NPK, pH, EC, SOM, texture and structure of soil
07/04/13-06/06/13	BUFA	Students	17	36	Soil Analytical training Course	sampling, profile, CaCO3%, NPK, pH, EC, SOM, texture and structure of soil
14/07/13-03/09/13	BUFA	Students	19	36	Soil Analytical training Course	sampling, profile, CaCO3%, NPK, pH, EC, SOM, texture and structure of soil
15/10/11-18/10/11	DC	Extension from 14 Districts	27	12	soil sampling and profile	presentation and field practical
02/06/13-04/06/13	DC	Extension Staff	30	12	Soil samping and testing	presentation, field and lab practical
26/04/12-28/05/12	DC	NGOs	10	12	Soil sampling and profile	presentation and field practical
2012/13	FUFA	Technicians	3		in service training	sampling, profile, CaCO3%, NPK, pH, EC, SOM, texture and structure of soil
30/04/12-10/06/12	FUFA	Professor	1	50	in service training	NPK, SOM, pH,EC and CaCO3%
2012/13	DC	JDA interns	10	12	active carbon and soil sampling	
11/07/2013	Samangan	Farmers	14	1	Soil sampling and Cons Ag.	theory and practical
24/10/13	Kaldar	Farmers	12	1	Soil sampling and Cons Ag.	theory and practical
11/05/2013	Sholgara	Farmers	12	1	Soil sampling and Cons Ag.	theory and practical

Discussion

As we have worked closely to build the capacity of BUFA technicians and DAIL soil scientist, Ghulam Nabi, the relationship between BUFA and DAIL has strengthened. We see a feasible and highly desirable model where the BUFA soil lab would be a joint facility of DAIL and BUFA. Generally the two institutions have not worked together closely, but while having at least this one facility is important for agriculture in northern Afghanistan, it is unlikely to sustain two. We have shown that the two departments can work together, and farmers coming to DAIL with their soils, in turn taken to BUFA for analysis by BUFA or DAIL staff, and results and recommendations delivered to DAIL is highly feasible. Increasing the use of the lab improves its potential to be sustainable, since it keeps technicians in good practice, uses reagents which otherwise lose their period of viability, and builds a positive reputation for BUFA which enhances its agency to continue.

Challenges and Recommendations

The soil lab is able to receive payment for sample analysis, but this must be submitted to the university and finally to the Ministry of Finance. Financing of the lab is possible but must be applied for through an independent process. Government employees at the university and in the agricultural department alike find this process so daunting for a range of reasons, that they typically do not undertake it. Therefore ongoing funding for the lab is a challenge.

Photo 22 Farmers and extension agents learn how to take soil samples for lab analysis.

Soil labs in Afghanistan are used at limited volumes, and each has challenges in staff capacity and procurement processes. The incentive for attaining consistent and high standards in labs is limited and processes for support or auditing low. We feel that the development of relationships between Herat, Jalalabad, Kabul, and Balkh soils labs could be an important part of addressing these challenges. The peer support would provide some accountability, peer to peer training, sharing of knowledge and experience gained in independent training inputs, and joint procurement.

Photo 23 studying a soil profile with IDEA NEW soil scientist at a hub location

Photo 24 farmers learn how to prepare a soil sample for lab analysis

Weed Control Training

This course should be 1 day training plus at minimum a field follow up visit during spraying. It can be done in 1.5 days, but is better carried out over 2.5 days with the second half day for field visits.

Training Day 1 – Main components and their objectives are:

A. Introductory Discussion

During this the trainer will become familiar with the farming system, the challenge of weeds at that location, and the interest and capacity of farmers. This will enable the trainer to learn from farmers, for farmers to learn from each other, and for the trainer to establish rapport, and tailor the training to the farmers and environment that they are in.

B. Learning Points Checklist

We have identified some key knowledge or skill areas that farmers are likely to need, not all will be necessary but this is a checklist of some. Lessons from training part A. should be used to determine where priorities will lie for this section.

C. Sprayer Ownership / Management / Handover

A lack of access to a sprayer can be a problem and booms are not available at all. We have found that groups are willing to share a sprayer, even with outsiders, but discussion of roles and responsibilities is helpful for successful group ownership. This section should increase the usage and life of the sprayer. A user log also helps us with follow up surveys.

A: Weed Control Introductory Discussion

1) What impact on yields do farmers think weeds have in their fields?
2) Do the group members control weeds? If yes, how? If no, why? Do weed have any particular value?
3) What do they know about the weeds, can they name types? Broad or grass leaved types? Are they experienced with spraying weeds? Discuss types that can be controlled, available herbicides, and times of spraying?
4) What is the most common type of weed in your area?

B: Training Main Content Checklist

1) Herbicide Application Safety – hazards, health, storage of chemicals, disposal.
2) Negative impact of weeds e.g. decreases yield maybe 30 %; N and seed rate relationship.
3) Weed population increase over time – self seeding, ploughing in.
4) If weed controlled at right time then more easily killed, and before damage to wheat.
5) Application timing specifics: weed and wheat stages; danger periods i.e. heat, frost, wind.
6) Herbicide Selection – give brochure and describe how to use.

7) Sprayer: Type of Nozzles; Multiple Nozzles booms how to get good coverage; Sprayer Assembly; Pressure regulation; Speed; Nozzle Height from soil surface
8) Showing of Weed posters (Safety, Herbicide side effects)
9) Herbicide Rates of available herbicides.

C: Backpack Sprayer Handover

1) Introduce and ask for agreement of interests to receive a sprayer
2) The group must agree on each of the following (give time for discussion): a. Where they want to keep the sprayer; b. Who will be allowed to use it i.e. non-group farmers; c. Terms of use i.e. payment or lend and different for non-group farmers; d. Maintenance and repair, who will do it if broken, who will pay.
3) Ask if they want to record the use, no problems if high or low but useful for us: give log book.