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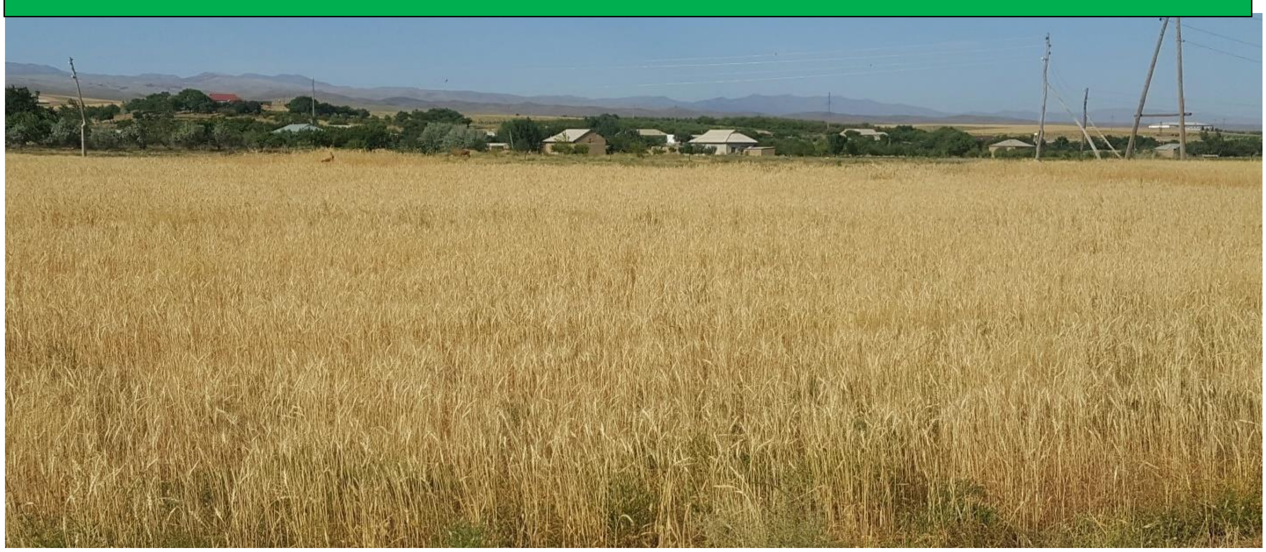
Farmer field school information diary for facilitators

Wheat production on small farms in the cold winter deserts of Uzbekistan



ICARDA
Science for resilient livelihoods in dry areas

Farmer field school information diary for facilitators

Wheat production on small farms in the cold winter deserts of Uzbekistan

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Contents

1. Introduction

Wheat (*Triticum aestivum L*.) is the most important food crop of Uzbekistan and plays a vital role in food security and nutrition of the country. Wheat is produced on approximately 1.3 million hectares with a production of above 6 million tonnes (6.3 million tonnes in 2020). Wheat growing environments are diverse ranging from mild winter in Surkhandarya region to extreme cold in Karakalpakstan region. Wheat is primarily (85 percent) cultivated as an irrigated crop. However, there are regions such as cold winter deserts (CWD) where irrigation facilities are not available, and wheat is grown as a rainfed crop.

Wheat is primarily cultivated as a strategic crop on well-organized farms, however, there are many householders and farmers with smallholdings who are not a part of the organized wheat production network. Such smallholders primarily produce wheat for home consumption. Many smallholders are inhabitants of CWD who grow wheat on small pieces of land around their house or rent from the government organization managing CWD lands. There is a lack of information flow on an improved methods of wheat production to the small farmers living in the remote CWD regions. Farmers Field School (FFS) is a useful approach to deliver information on an improved methods of wheat production to such remote regions. This document has been prepared to serve as a guideline diary for the facilitators who would be involved in implementing FFS with the small farmers in the CWD of Uzbekistan. However, this guide document would also be useful for small wheat growers beyond the CWD region.

This guidance document has been prepared considering that the FFS approach is a participatory learning method, and the facilitators role is to get farmers involved in the wheat production activities in terms of decision-making to adopt new wheat varieties. At the end of the crop cycle, the farmers should have learned enough to sustain the benefits they will achieve through the adoption of new wheat varieties for improving the productivity of their limited land.

2. Preparations for Farmer field school activities

1. Prepare a list of the participant farmers (Annex Form 1).

2. Decide on the venue for the gathering of up to 25 farmers.
    - Public meeting places such as schools, village administration office.
    - Private places for farmers.
    - Hotel meeting hall.
    - Restaurant hall.
3. Preparation of meeting place.
    - Inspect in advance the venue for general appearance.
    - Make sure the electricity supply will remain uninterrupted during a meeting.
    - Make sure there are enough numbers of chairs.
    - There is an arrangement of snacks, and meals needed during the session.
4. Preparation of supplies for the meeting.
    - Notebook.
    - Pens.
    - Writing board with markers and dusters.
    - PowerPoint presentation facilities.
    - Camera for taking photos.
    - Others.

Materials needed for the Farmer field school

It is important to prepare as complete as possible list of materials that would be needed for the Farmer field school session to be discussed. There may be additional materials needed during the individual training session for which flexible arrangements should be made.

Training in the fields will require different sets of materials. There may be transportation needed to carry the trainees to the field site.

3. Selection of wheat variety

Choosing the right variety for a given soil and climate with the following traits is important to achieve greatest yield. This information can be obtained from the district agricultural office or the institute that developed the variety.

Characteristics of a good variety.

1. Suitable for intended planting date (early, prompt and late).
2. High yield potential.
3. Early maturity.
4. Medium tall plant height.
5. Lodging tolerant.
6. Resistant to yellow rust.
7. Heat tolerant.
8. Salinity tolerant.
9. High straw yield.
10. Satisfactory bread quality.

4. Selecting good quality seed

Information on seed quality is often available on the seed bag. Seed should be bought from a reliable source and not from the grain market, which is often a practice in the rural areas where information is not available to the farmers about the availability of quality seed suppliers.

Characteristics of good quality seed:

- Normal health and bright in color without any physical or mechanical injury.
- Genetically pure free from contaminations such as other crop seed, weed seed and inert materials.
- Free from seed-borne disease.
- Germination > 85 percent.
- Moisture content <12 percent.
- All seed kernels should be more or less of equal size and the same color.
- Produced in the earlier crop cycle as reflected in the date of packaging.
- Treated with the chemical for controlling seed-borne diseases.

5. Wheat seeding (Annex Forms 2 and 3)

Wheat seeding needs several steps to be considered proper to ensure good crop germination and seedling establishment.

1. Land preparation.
   - Surface tillage to get rid of weeds and allow placement of seed below the soil surface.
   - The soil surface should be free from clods.
   - Soil should be moist to allow germination.
   - In dry fields, light irrigation should be provided after seeding.

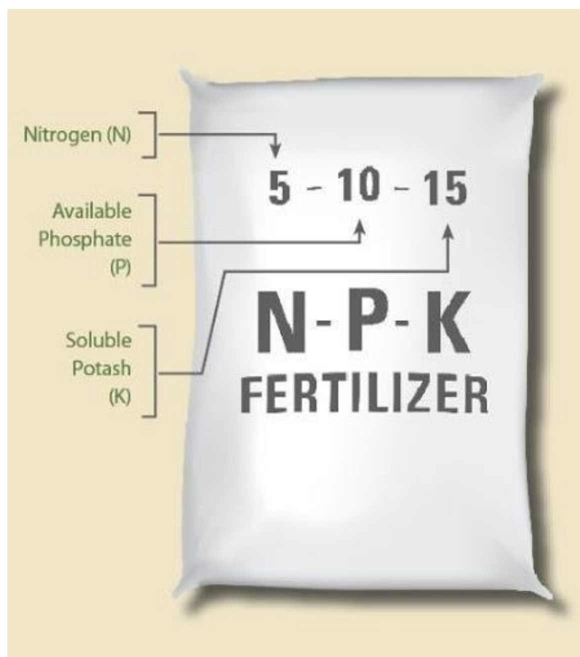
2. Seed rate: 200 kg/ha.
3. Seeding method.
   - Seeds can be either broadcasted on the soil surface or planted in a row by making a furrow and placing the seeds in the furrow.
   - Seeding in a row should be preferred over broadcasting.
   - Broadcasted seeds lying on the soil surface are prone to be eaten by birds.
   - It is difficult to undertake intercultural operations such as mechanical weeding in standing crop planted by broadcasting.
4. Distance between rows 25 cm.
5. Make sure that seeds are covered by 2 cm of soil.

6. Fertilization of wheat crop (Annex Form 4)

Organic manures and chemical fertilizers play an important role in obtaining optimum yield from a wheat crop. Manures improve the general physical condition of the soil and increase its water-holding ability. However, manures alone, due to their low nutrient concentration, may be inadequate to meet the high nutrient requirement of the wheat crop. This needs additional nutrient application through chemical fertilizers to meet crop demands for producing the desired yield.

- If possible, soil analysis should be conducted to understand the nutrient status of the crop and apply manures and fertilizers based on the soil analysis reports.
- Apply 10 to 15 tonnes per hectare of well- rotten manure or compost a few weeks before wheat seeding.
- Apply chemical fertilizers considering the following factors:
    - The correct dose of fertilizer based on nutrient content and crop need.
    - Appropriate time of application.
    - The proper method of application.

- Nitrogen should be applied in split doses under irrigated condition.
    - 1/3 mixed in the soil at the time of seeding.
    - 1/3 in early spring when the soil is wet from rain or snow.
    - 1/3 at the early grain-filling stage.
- All nitrogen should be applied at sowing time for rainfed crop.
- All phosphorous and potash should be applied at the time of seeding by mixing them into the soil.
- Apply one or more micronutrients if suggested in soil analysis.



Source: Trawick R.2012," Fertilizers Are Easy". In: *University of Florida, IFAS Extension*, Accessed on March 12,2012. Available from: https://nwdistrict.ifas.ufl.edu/hort/2012/03/12/fertilizers-are-easy/

7. Evaluating crop stand (Annex Form 5)

Germination followed by a good plant stand is the first field indication of a healthy wheat crop. If the crop stand is poor, the crop can be discarded and another crop planted so that the farmer doesn't lose the season. Since winter wheat can get killed by freezing temperatures during winter months, it is advised that plant population be measured before and after winter.

Methods of measuring plant population

1. Visual – the crop coverage of the land looks normal.
2. If crop coverage is sparse, count the number of plants in 1 square metre.
3. If the crop is planted in a row, count the number of plants in a one-metre linear row and estimate the number of plants per square metre based on the spacing between adjacent rows.
4. If the crop is broadcasted, make a square wooden frame of 1 square metre and estimate the number of plants falling within the wooden frame enclosure.
5. Since the plant stands may not be uniform all over the field, measure five samples randomly selected in the field, and estimate the number of plants per square metre.
6. Measure plant population before winter and after winter to estimate winter kill.
7. Record the data in the data sheet (Annex Form 5),

8. Irrigation of wheat crop (Annex Form 6)

The water requirement of winter wheat to meet the demand of evapotranspiration (ET) depends on wheat variety, crop growth stage, canopy structure, plant density, climatic and soil conditions, and irrigation and crop management practices. There is a normal practice of applying light irrigation after planting to ensure germination if the soil is dry. Depending on water availability four to six irrigations are given based on soil moisture conditions and crop growth.

The critical growth stages of the wheat crops for supplying irrigation are crown root initiation (CRI), the first node, jointing (stem elongation), boot, milk and dough. Depending upon the availability of water one to six irrigations are recommended below.

One irrigation – CRI stage
Two irrigations – CRI and booting stages
Three irrigations – CRI, jointing and milk stages
Four irrigations – CRI, the first node, joint and milk stage
Five irrigations – CRI, the first node, jointing, boot, and milk stages
Six irrigations – CRI, the first node, jointing, boot, milk and dough stages

- Irrigation should be applied uniformly over the entire field.
- Land should be well leveled for uniform irrigation of the field.
- In the case of wheat planted on ridges, irrigation can be applied in the furrow to save water.
- Enter information about irrigation in the proper form (Annex Form 6).

9. Weed control in wheat (Annex Form 7)

Weeds are unwanted plants in the wheat field that can cause grain yield reductions. Under severe weeds infestation a wheat farmer may have to abandon the crop. Therefore, weeds must be controlled in a prompt fashion to avoid their competition with wheat plants for nutrients, water, and sunshine.

Methods of weed control.

i) Preventive measures

- Use weed-free clean seeds.
- Use well-decomposed organic manure and compost.
- Keep irrigation channel free of weeds before using for irrigation of wheat crop.

ii) Cultural method

- Use crop rotation with different crops.
- Use Dense planting of wheat using narrow row spacing to smother weeds.
- Use improved soil fertility for more vigorous wheat plants to compete with weeds.

iii) Mechanical method

- Destroy weed plants during land preparation through deep ploughing.
- Mechanical removal of weeds from the crop by hand or hoe in the early growth stage of crop.

iv) Chemical method

- Depending on the type of weeds, use proper herbicides available locally.
- Information on herbicides can be obtained from the district agricultural department or a nearby research institute.

Note: Enter data in Annex Form 7.

10. Disease control (Annex Form 8)

Yellow rust is the only major disease occurring on wheat crops in those years when there is persistent rainfall. Otherwise, the wheat crop in the cold winter desert is usually free from diseases that could cause economic damage.

Symptoms of yellow rust on wheat plants.

The characteristic symptom of yellow rust is yellowish-orange pustules arranged in stripes on leaves. Under severe infections, the symptom may also appear on spikes and inside the glumes. Leaves may dry prematurely resulting in grain yield reductions.

Control measures

- Plant yellow rust-resistant varieties such as Gozgon, Shams and Bunyodkor.
- Spray fungicide available locally.
- Consult the district agricultural department or nearby research institute for advice.

Note: Enter data in Annex Form 8

11. Recording grain yield components (Annex Form 9)

Three components make the grain yield of wheat.
Number of spikes per unit area (A)
Number of grains per spike (B)
Grain weight (C)

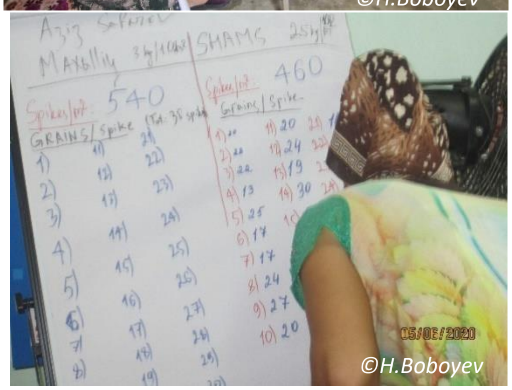
Estimated grain yield = A × B × C

- Different varieties may have different combinations of grain yield components to produce similar yields.

- Often farmers prefer one or more yield components and select varieties accordingly.

- Wheat varieties with larger seed sizes may be more appealing in the market and sometimes sold at a higher prices.

- A higher volume weight of wheat grain is considered a superior quality for bread making industry.



Note: Record data in Annex Form 9.

12. Harvesting, threshing and storage of wheat

Harvesting

- A wheat crop should be harvested when the grains become hard, and the straw becomes dry and beaks easily.
- The grains easily separate from the spike upon rolling between the palms.
- A delay in harvesting can result in losses due to shattering of grains; some varieties are susceptible to the shattering.
- Any delay in harvesting may result in the lodging of the dry wheat plants due to gusty winds.
- An extended delay in harvesting may negatively affect the quality of grains.
- A rain-fed wheat crop can mature to the harvest stage much earlier than the irrigated crop.

Threshing

- The use of a combine harvester is much more efficient by enabling harvesting and threshing simultaneously.
- Harvesting on smallholders' wheat fields is done by a hand tool.
- The harvested plants should be tied in small bundles and gathered in heaps in the field for threshing by a stationary thresher.

Grain storage

- The grains should be thoroughly dried to a moisture level below 10 percent before storage.
- Drier grains can be stored well until the next planting.
- Grains should be stored in proper containers depending on the amount.
- Commonly used containers include sacks, pits, bins, or concrete structures.

- The storage containers should be moisture-proof and should be fumigated with a recommended chemicals to keep down the storage insect pests and rodents.

Note: Record data in Annex Form 3.

Annex Form 1: Information about the participant farmers

No.	Name of the farmer	Gender (Male/Female)	Phone number	Total land owned (ha)	Land to be planted under wheat	Number of years of experience in wheat planting
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

Annex Form 2: Information about the quantity of seed needed

No.	Name of the farmer	Name of wheat variety	Land to be planted by wheat (ha)	Seed rate (kg/ha)	Seed needed (kg)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
Total			**xx**	**xx**	**xx**

Annex Form 3: Data of agronomic practices to be recorded by each farmer

1. Name of wheat Variety:
2. Area planted:______________ha
3. Seed rate:__________kg/ha
4. Seeding date: (date/month/year)_____/____/_______
5. Planting method: Broadcast / hand plant in row / seed-drill
6. Spacing between rows: _________cm
7. Germination date: (date/month/year)_____/_____/_______
8. Plant number per square before winter:__________ per square metre
9. Plant number per square after winter:__________per square metre
10. Winter kill:___________percent
11. Heading date (when all spikes out of boot): (date/month/year)_____/_____/_______
12. Plant height at maturity (from soil level to tip of spike):________cm
13. Number of spikes per square metre: __________
14. Grain per spike (average of 20 spikes):
15. Weight of 1000 grains: ________ g
16. Maturity date: (date/month/year) ____ /_____/_______
17. Harvesting date: (date/month/year)_____/_____/_______
18. Method of harvest (by hand or by combine):
19. Grain weight after threshing:________kg form________ha
20. Grain moisture content:_________percent

Annex Form 4: Information on manures and fertilizers applied to the crop by individual farmers

	Name of fertilizer	Nutrient content (percent)			Rate (kg/ha)	Date of application	Method of application
		N	P_2O_5	K_2O			
Manure	Organic manure or Compost						
N							
P							
K							
Ca							
Mg							
B							
,,,							
,,,							
,,,							
,,,							
,,,							

Annex Form 5: Estimating plant population before and after winter

Sampling area = 1 square metre, 5 samples taken randomly from the field.

Date	Variety	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Average
Before winter Date:							(A)
After winter date:							(B)
At maturity date*:							(C)

*Count the number of spikes instead of the number of plants.

Winter kill = 100*((A-B)/B) percent.

Number of spikes per ha = C*10,000.

Annex Form 6: Record of irrigation

Irrigation number	Date date/mo/year	Crop growth stage	Method of irrigation Surface/furrow/other	Quantity of water applied (if known)
1st				
2nd				
3rd				
4th				
5th				
6th				
7th				
8th				
…..				
…..				

Growth stages

Growth Stage	Description of stage
	Seedling growth
GS10	First leaf through coleoptile
GS11	First leaf unfolded (ligule visible)
GS13	3 leaves unfolded
GS15	5 leaves unfolded
GS19	9 or more leaves unfolded
	Tillering
GS20	Main shoot only
GS21	Main shoot and 1 tiller
GS23	Main shoot and 3 tillers
GS25	Main shoot and 5 tillers
GS29	Main shoot and 9 or more tillers
	Stem elongation
GS30	Ear at 1 cm (pseudostem erect)
GS31	First node detectable
GS32	Second node detectable
GS33	Third node detectable
GS37	Flag leaf just visible
GS39	Flag leaf blade all visible
	Booting
GS41	Flag leaf sheath extending
GS43	Flag leaf sheath just visibly swollen
GS45	Flag leaf sheath swollen
GS47	Flag leaf sheath opening

Growth Stage	Description of stage
	Ear emergence
GS51	First spikelet of ear just visible above flag leaf ligule
GS55	Half of ear emerged above flag leaf ligule
GS59	Ear completely emerged above flag leaf ligule
	Flowering
GS61	Start of flowering
GS65	Flowering half-way
GS69	Flowering complete
	Milk development
GS71	Grain watery ripe
GS73	Early milk
GS75	Medium milk
GS77	Late milk
	Dough development
GS83	Early dough
GS85	Soft dough
GS87	Hard dough (thumbnail impression held)
	Ripening
GS91	Grain hard (difficult to divide)
GS92	Grain hard (not dented by thumbnail)
GS93	Grain loosening in daytime

Wheat growth stages

The Decimal Code system for measuring wheat growth used throughout this guide is based on work published in Tottman, DR & Broad, H (1987) The decimal code for the growth stages of cereals, with illustrations. Annals of Applied Biology **110**, 441–454.

Annex Form 7: Data on weed management

	1st Weed control date Date/mo/year	2nd weed control date Date/mo/year	
Method of weed control*			
Name of herbicide, if applied			
The active ingredient in the herbicide, if applied			
Rate of herbicide Quantity/ha			

*Preventive/cultural/mechanical/chemical.

Annex Form 8: Disease control measure

Name of wheat variety:

Name of the disease:

Date of first appearance:

The severity of disease:

Chemical applied:

Name:

The concentration of active ingredient:

Rate of chemical applied:

Date of chemical spray (date/mo/year):

Crop growth stage when chemical sprayed:

Cost of chemical:

Note: If more than one spray is used, record the above data for each spray.

Annex Form 9: Recording grain yield components

Date of recording data on the components (date/mo/year):

Spike number	Variety	Grain number	Grain weight (g)			
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
Total		A	B			
Average		A1	B1			

A1 = A/20 per spike.

B1 = B/A.

1000-grain weight = 1000*(B/A).

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