

# Wheat Seed Production Techniques

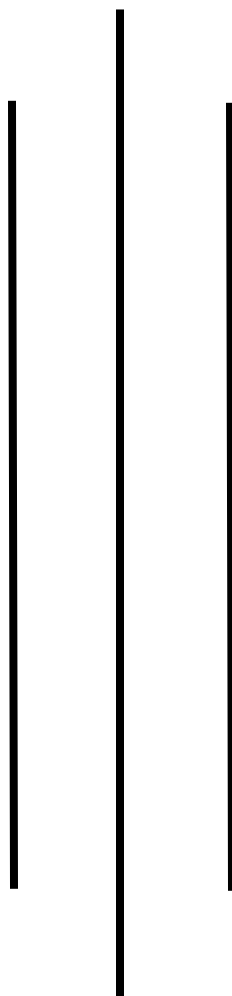
## Manual



District Agriculture Development  
Office, Sindhupalchwok

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## Manual



District Agriculture Development  
Office, Sindhupalchowk

Government of Nepal  
Ministry of Agriculture Development  
Regional Agriculture Directorate, central development Region  
**DISTRICT AGRICULTURE DEVELOPMENT OFFICE**  
**Sindhupalchok, Chautara**

**Acknowledgement**

Training Plays important role for the Change in behaviour by improvement of knowledge, skill and ability of the farmers. To follow up and enhance more technically about the local methods, techniques, learning and experiences with current climatic requirement and technical needs are our major responsibility. Good Agricultural practices, traditional knowledge, skill and experience as well as research output techniques will be very helpful for successful Agriculture work. Successful Agriculture works refers to increment in the production of cereals, vegetables and cash crops as well as their marketing for raising the income. Management of the problems which arises during the farming like; disease pest occurrence, soil, Agro-materials also falls under the successive Agriculture work.

Regarding to the emerging context for commercialization, raising income and upliftment on livelihood of farmers by technical enhancement in simple way, we feel very happy by the preparation of Wheat Seed Production Technique Manual with very useful technical knowledge. This manual which is prepared under the JICA project on Rehabilitation and Recovery from Nepal Earthquake (RRNE) not only useful for rural Farmers, but also very useful for every technician related to Agriculture offices for the training material. It has been hoped that this manual, especially addressing the wheat seed production techniques will support for the increment of the productivity, improving in quality wheat seed production.

JICA/RRNE and Good Neighbours Nepal has helped much more for the preparation, correction, edition, all other related works and funding. I am also glad to assisting the preparation of this manual directly and indirectly by all persons, DADO technicians and technicians of Agriculture service centre. I am hoping for this type of manual publication support by all readers and JICA Nepal in near future containing other precise and important training contents and materials.

March, 2016

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Senior Agriculture Development Officer

## Table of Contents

PART I: DEFINITION AND IMPORTANCE OF QUALITY SEED .....	1
1. Background .....	1
2. Definition of Seed .....	2
3. Features of Quality Seed .....	2
4. Importance of Good Quality Seed .....	2
PART II: METHOD OF WHEAT SEED PRODUCTION .....	3
A) Technical Aspects for quality Seed Production .....	3
5. Basic Knowledge for Wheat Seed Production .....	3
5.1 General schedule for wheat cultivation and technical work .....	3
5.2 Climate and soil condition .....	7
5.3 Marketing plan .....	7
5.4 Selection of land .....	7
5.5 Crop rotation for reducing disease and pest .....	8
6. Works before Cultivation of Wheat .....	9
6.1 Selection of variety .....	9
6.2 Conformation of purchased foundation seed .....	10
6.3 Germination test of foundation seed .....	10
6.4 Treatment of seeds before sowing .....	11
6.5 Land preparation and sowing of wheat .....	14
7. Farming Activities during Growth Period .....	16
7.1 Weeding and Top dressing .....	16
7.2 Irrigation .....	16
7.3 Pressing .....	16
7.4 Field inspection .....	17
8. Major Pest and Diseases in Wheat .....	18
8.1 Major pests in wheat .....	18
8.2 Major diseases and their control .....	20
9. Harvesting .....	21
9.1 Timing of harvest .....	21

9.2 Method of harvesting .....	22
9.3 Threshing.....	22
10. Post-harvest Processing and Storage .....	22
10.1 Cleaning the seed .....	22
10.2 Drying.....	23
10.3 Storing seeds in storage.....	23
B) Management Aspects for Quality Seed Production .....	26
11. Necessity of Management by Seed Production Cooperative .....	26
12. Structure and Roles of Seed Production Cooperative.....	26
13. Major Actions to Be Taken by Seed Production Cooperative .....	28
13.1 Land and variety selection.....	28
13.2 Quality control and record keeping.....	28
13.3 Collection of produced seeds and storage .....	31
13.4 Standard for seed certification.....	32
13.5 Packaging .....	32
13.6 Warranty tag.....	32
13.7 Advertisement and sales.....	34
14. Skilled Human Resource Development under Seed Production Group and Cooperatives for the Quality Seed Production .....	34
Compost .....	35
PART 1: Farm Yard Manure (FYM) .....	36
1. Introduction.....	36
2. Advantages of Well Decomposed Farm Yard Manure (FYM) .....	36
2.1 Improvement of soil productivity.....	36
2.2 Healthy for plants .....	37
2.3 Good means of breakdown of organic matter .....	37
3. Material Required for Making FYM.....	37
4. The Place for Making FYM.....	37
5. Condition Required for Well Decomposition of FYM .....	39
6. Collection of Animal Urine and Its Advantages.....	40

6.1 Collection of urine.....	40
6.2 Advantage of collecting urine .....	40
7. Things to Be Considered While Making Farm Yard Manure (FYM) .....	41
PART 2: COMPOST MANURE .....	42
8. Introduction.....	42
9. The Advantages of the Compost Manure .....	43
10. The Materials Required for Making Compost Manure.....	43
11. The Place for Making Compost Manure.....	43
12. Methods of Preparing Compost Manure.....	43
12.1 Methods of preparing compost in pit .....	43
12.2 Heap method .....	47
13. Identifying the Well Decomposed Compost and FYM .....	48
References .....	49



## **PART I: DEFINITION AND IMPORTANCE OF QUALITY SEED**

### **1. Background**

Quality seed is very important thing for increasing the production. It is necessary to maintain the varietal characteristics of seed, and control the seed borne disease for the production of high quality seed. This manual tries to improve the knowledge on farmers about technical and management activities during the wheat cultivation, and support for improvement of quality seed production. The improved technical and management farming activities will be supportive for quality seed production, and raising livelihood of farmers living in the hilly areas.



Fig. No. 1.1: Wheat plants with mature spikes

Source: JICA Project Team

## **2. Definition of Seed**

“Seed” means a matured ovule having embryonic plant, food substance and protective cover or seeds or germ which can be used in sowing or planting to produce crop by reproducing in sexual or asexual mode. (Seed Act, 1988). Seed is a live embryo in dormancy mode with or without cover, which can grow as a fully developed plant under a favourable environment.

## **3. Features of Quality Seed**

Characteristics of quality seed are as followings:

- Seed purity
  - It should have genetic purity.
  - It should have physical purity (no mix of other crop seed, weed seed & inert matter).
- It should have high germination vigour, germination rate and sprouting capacity.
- It should be free from seed born disease and pests.
- It should be good seed shape, size and weight for producing good seedlings.
- It should be healthy and shining without any spot and weakness on looking.
- It should be in equal size and weight, which should have uniformity on germination after sowing.
- It should have standard moisture level (maximum 12%) in wheat seed, which should clink while biting and shaking by hand.

## **4. Importance of Good Quality Seed**

- Quality seed gives more production in comparison to normal seed.
- It also leads to increment of production and income of farmers.
- Quality production from quality seed can be easily traded in the market.
- If high quality seed is produced in the mid-hill region of Nepal, the production of wheat will be raised in that area.
- The variety selected from Nepal has higher adaptability and more resistant than the seed imported from foreign country.
- There are many pocket areas for quality seed production in mid-hill region, which is also easily accessible to remote farmers.



## **PART II: METHOD OF WHEAT SEED PRODUCTION**

In techniques of quality seed production, there are the following two aspects:

- Technical Aspect: where various techniques are adopted for producing quality seeds
- Management Aspect: where the individual farmers are managed through cooperatives and groups, in order to secure sufficient quality of seeds and stable sales of the products.

### **A) Technical Aspects for quality Seed Production**

#### **5. Basic Knowledge for Wheat Seed Production**

##### **5.1 General schedule for wheat cultivation and technical work**

The general schedule for wheat cultivation and technical work indicated in the following table.

**Table No. 5.1.1: Wheat cropping calendar**

Week	Stages of plant	Activities			Farm work
		Field inspection	Fertilizers application	Pests and disease control	
<b>1<sup>st</sup> Week Oct. – 2<sup>nd</sup> Week Oct.</b>	Land preparation		Initial stage: FYM: 50-60 DOKO (250-300 kg / Ropani)		Use well fermented FYM (Farm yard manure) 1 <sup>st</sup> ploughing
<b>Last Week Oct.</b>	Seed treatment by fungicides: Captan or Thiram		Apply the following amount of fertilizer to the field and plough the land before sowing. Urea: 4 kg/ Ropani DAP: 5 kg/ Ropani Potash: 2 kg/ Ropani		2 <sup>nd</sup> ploughing
<b>1<sup>st</sup> - 2<sup>nd</sup> Week Nov.</b>	Sowing seed and pressing soil				250 – 300 seed / square meter (3.5 kg/ Ropani)
<b>Last Week Nov. - 1<sup>st</sup> Week Dec.</b>	Crown root initiation		1st top dressing: Urea 2 kg / Ropani		First Weeding First irrigation
<b>3<sup>rd</sup> Week Dec. – Last Week Dec.</b>	Three tiller formation stage				First pressing of plants

Week	Stages of plant	Activities			Farm work
		Field inspection	Fertilizers application	Pests and disease control	
<b>1<sup>st</sup> Week Jan. – 3<sup>rd</sup> Week Jan.</b>	Tiller development stage	1 <sup>st</sup> field inspection:  Uproot and remove diseased and off types plants		White grub Cut worm Leaf blight Yellow rust Aphids	Second pressing (10 days after the first pressing)
<b>2<sup>nd</sup> Week Feb. – 4<sup>th</sup> Week Feb.</b>	Plant elongation stage		2 <sup>nd</sup> top dressing: Urea 2 kg / Ropani		Second Weeding
<b>2<sup>nd</sup> Week Mar. - 4<sup>th</sup> Week Mar.</b>	Spike initiation stage				Second irrigation
<b>4<sup>th</sup> Week Mar. – 2<sup>nd</sup> Week Apr.</b>	Spike formation				
<b>Last Week Apr. – 2<sup>nd</sup> Week May</b>	Flowering stage	2 <sup>nd</sup> field inspection:  Uproot and remove diseased and off types plants		stinking smut(hill bunt) Loose smut Leaf blight Yellow rust Aphids	

Week	Stages of plant	Activities			Farm work
		Field inspection	Fertilizers application	Pests and disease control	
<b>1<sup>st</sup> Week Jun.</b>	Grain(seed) ripening	3 <sup>rd</sup> field inspection:  Uproot and remove diseased and off types plants			
<b>2<sup>nd</sup> Week Jun. -3<sup>rd</sup> Week Jun.</b>	Harvesting stage				Harvest the crop during dry and sunny day

Source: JICA Project Team

## **5.2 Climate and soil condition**

### **(A) Climate**

- Wheat crop is major crop of hilly region; however, it is cultivated both in hills and Terai region.
- Wheat crop requires cold and dry weather conditions. The optimum temperature for germination is between 20 °C and for vegetative growth ranges from 16-22 °C.
- If the weather becomes cool and it dewes, the wheat plants grow many shoots and give more grains.
- The wheat plants can be under attack of disease and pests if the weather is very hot and humid at the time of sowing seeds.

### **(B) Soil**

- Wheat can be cultivated in various types of soil.
- Fertile loamy black soil and the soil with good water holding capacity is appropriate for wheat cultivation.
- It is better to cultivate wheat in a soil that can hold little more water even in the dry season.
- The soil of the field for wheat cultivation should not be more acidic and alkaline.

## **5.3 Marketing plan**

Before seed production, Cooperative should consider how much seeds that could be sold in the market, and how much quantity of seed can be stored in their storage. By considering this, Cooperative should make the plan of selecting the land and cultivation for seed production.

## **5.4 Selection of land**

Land selection shall be done in coordination with seed production Cooperative. For Wheat Seed production, clean, plain, and fertile and land with a good drainage facility should be selected, and consider the following things to select such plot:

- Seed production plot should be fertile land with easy facility of irrigation and drainage. Wheat crop generally does not need irrigation; however irrigation is necessary at tillering and flowering stage).
- Easily accessible for supervision or field inspection.
- The land selected for seed production should not be diseased in previous crop time or it should be less infested with diseases or pests.
- It is appropriate to cultivate in a block of land than in small plots of land for seed production. It is better not to cultivate wheat for seed production for two years if the loose smut disease appears in the land.



- It is necessary to maintain spacing between the plots of wheat grown for seeds and wheat grown for cereal food or wheat of different variety for seeds as per the certified standard. To maintain spacing, a small plot between the cultivated plots should be left empty or barren.
- Wheat crop is a self-pollinated crop; hence, there will be less problem of external pollination. However; the isolation distance should be maintained in order to avoid transfer of diseases.
- Three meters of isolation distance between the different varieties of wheat crop cultivated for seeds or for different purposes is necessary. Likewise, if any variety of wheat is infested by loose smut disease, a spacing of 150 meters is necessary between the plots.

### 5.5 Crop rotation for reducing disease and pest

- For controlling disease and pest, wheat should not be planted in the same plot and crop rotation should be adopted in every 3 years for seed production.
- If farmers cultivate wheat every year, virus and other soil borne diseases will be increased. Hence, wheat produced from such field could not be used as seed.
- The crop rotation can be adopted as given below:
  - First of all farmers should divide their wheat seed production field into 3 plots.
  - In the first year, cultivate the wheat in 1<sup>st</sup> plot and cultivate potato in 2<sup>nd</sup> plot, and if possible cultivate legume or remain fallow in 3<sup>rd</sup> plot.
  - In 2<sup>nd</sup> year continue the same procedure following same time and season ,but rotate the crops i.e. wheat will be in 2<sup>nd</sup> plot, potato in 3<sup>rd</sup> plot and legume will be in 1<sup>st</sup> plot
  - In third year, do same as before by rotating the crop.
  - This way of every three years, there will be changing the crops in farmers' field, which will help to eradicate the disease and pest in the seed t production field. The figure below indicates the crop rotation for 3 different plots for the period of 3 years:

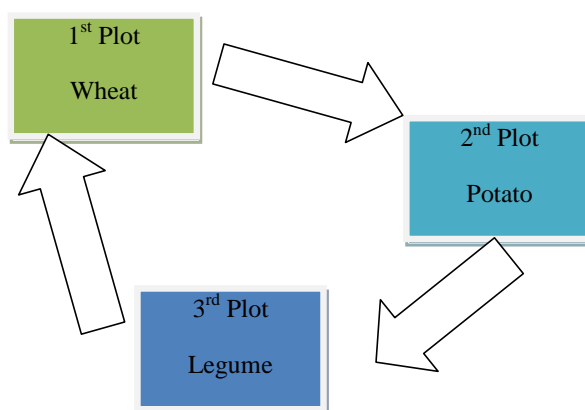


Fig. No. 5.5.1: Concept of crop rotation for Wheat seed production

Source: JICA Project Team

## 6. Works before Cultivation of Wheat

### 6.1 Selection of variety

- Selection of variety shall be done in coordination with seed production group / Cooperative, under the support of DADO.
- The recent variety, recommendation area, recommendation year, productivity and maturity days have been mentioned below.

**Table No. 6.1.1: Varieties of wheat**

S.N.	Varieties of crop	Recommended year (BS.)	Harvesting days	Production capacity (m/h)	Recommended areas
1	Lerma 52	2017	176	5.0	Mid hill
2	Annapurna 4	2051	161	5.0	Mid and High hill
3	Pasang Lhamu	2054	178	6.7	Mid hill (Such as Kathmandu valley and high hill having similar weather like that of Jumla)
4	Kanti	2054	174	5.5	Mid and high fertile land of hilly region
5	WK 1204	2064	179	3.4	Mid hill and high hill
6	Gaura (BL 3235)	2069	160	4.2 – 5.0	Mid hill and high hill
7	Dhaulagiri (BL 3503)	2069	156	3.6 – 4.9	Mid and high hill
8	B L 1473	2056	115	4.0	Terai, plain land and valley with height less than 1000 m and medium and high fertile land
9	Gautam	2061	119	3.4	Plateau/ plain land of Terai and mid hill

Source: Agriculture Diary, 2073

## 6.2 Conformation of purchased foundation seed

Among received foundation seeds from DADO or other relevant governmental authorities or other seed companies, the warranty tag of the foundation seed should be checked whether it is the right variety or not.

## 6.3 Germination test of foundation seed

Germination of seeds should be tested in order to identify the vigour and germination rate of seed which is necessary for the healthy and good growth of seedlings, and obtaining higher yield. If the seed has good germination vigour, higher number of seeds germination, it can be produced as expectation. The germination rate of seed can be identified in the following ways:

- Dip the seeds in water for 24 hours before the germination test.
- Prepare the 2 carton box with plastic film inside it, and then put fine sand or sandy soil in it.
- Remove small stones or pebbles from the sand/sandy soil in each cartoon box.
- Plain the surface, and make rows not deeper than an inch in each cartoon box.
- Sow 100 seeds in 10 rows (ten seeds for each row) in one carton box, and sow next 100 seeds similarly in next carton box.
- Water to each germination test box every day for making the soil wet.
- Start counting seedlings 5 days after sowing, and take record.
- The number of sprouts 5 days after sowing gives the vigour rate, and 8 days after sowing gives the germination rate.
- Average germination rate from two test box should be at least 85% for foundation seed.



Fig. No. 6.3.1: Carton(paper box) ready with Soil for germination testing of seeds



Fig. No. 6.3.2: Ten lines made in soil with finger



Fig. No. 6.3.3: Sowing wheat grains in 10 rows



Fig. No. 6.3.4: Wheat grains sowed in rows



Fig. No. 6.3.5: Covering the seeds with soil



Fig. No. 6.3.6: Watering the sown seed making sprinkler from water bottle

Source: JICA Project Team

#### 6.4 Treatment of seeds before sowing

- Due to infection in seeds, wheat crop gets different diseases like: smut, rust, blight etc. Due to these diseases, there is adverse effect on annual production of wheat.
- The infection from such diseases could be minimized or reduced by using only healthy, and quality seeds chosen through hot water seed treatment and treatment with fungicide, which is described detail below:

##### (A) Hot water seed treatment

- Initially, soak the seeds in ordinary water for about 4 hours, than dip in hot water 52 °C for 10 minutes or 55 °C for 5 minutes. After that, cool and dry the seeds in shade, and let for fungicide treatment.



**(B) Fungicides treatment of seed**

- It is compulsory to treat the seeds for producing quality and healthy wheat crop.
- Mix the wheat seeds before sowing with Bevistin or Benlate2 grams (0.2%) per kg seeds in an air tight pot and stir it vigorously for 8-10 minutes.
- Treating the seeds this way helps in controlling diseases and germs on outer surface of wheat grain such as blast, loose smut, etc.

Methods of seed treatment have been mentioned in pictures as followings:



Fig. No. 6.4.1: Seeds and Equipment for treatment



Fig. No. 6.4.2: Putting seeds into treating pot



Fig. No. 6.4.3: Taking out half spoon fungicides for 1 kg seeds



Fig. No. 6.4.4: Mixing fungicides in 1 kg seeds in pot





Fig. No. 6.4.5: Tightening lid of pot with fungicides mixed seeds



Fig. No. 6.4.6: Shaking the pot for well mixing of fungicides and seeds for 8 – 10 minutes



Fig. No. 6.4.7: Pouring out treated seeds in clean dish or other pot



Fig. No. 6.4.8: Treated seeds ready for sowing

Source: JICA Project Team

### **(C) Precautions during seed treatment**

The following things need to be considered while treating the seeds:

- Select non-windy place to treat seeds with fungicide so that air will not carry away the fungicide.
- Children, aged people, pregnant women are more vulnerable to poisonous effect of fungicide hence; they should not be involved in treating the seeds.
- Use mask, gloves, and goggles while treating seeds.
- Wear the clothes that cover whole body.
- Use only proper or prescribed amount of fungicides.
- Wash thoroughly with water when fungicide touches your skin directly.

## 6.5 Land preparation and sowing of wheat

### (A) Field sanitation before cultivation

In case residues of earlier crops remain in the field, the larva of the pest and disease of the previous crops stay alive in soil, and attack the new crops as well. Therefore, the field should be cleaned after harvest.

### (B) Application of FYM (Farm Yard Manure)

- Around 50-60 bamboo baskets of well-fermented FYM per Ropani of land should be applied during the land preparation or first ploughing (if possible 1-2 month earlier of planting time).
- Use of unfermented FYM (farm yard manure) can increase pest such as white grubs, cut worms and other worms.
- In case, heaps of FYM put in the field for long time, the nutrients in the FYM will be lost and insect may lay eggs in the heaps. So, it should be better spread the manure and plough the field immediately.

### (C) 1<sup>st</sup> ploughing

- 1-2 month before planting, during Dec-Jan first ploughing should be done.
- Plough the field two times, which will make the soil loose and make easy for aeration and root growth. In the first time, plough the field 5-8 cm deep and second time 10-15 cm deep ploughing should be done.
- In case, there is big size of soil clods present in the field after first ploughing, the breaking of those clods should be done manually with the help of spade before those clods become hard.



Fig. No. 6.5.1: Ploughing the land for wheat sowing

Source: Crop Development Directorate, Harihar Bhawan, Lalitpur

### (D) 2<sup>nd</sup> Ploughing and sowing of wheat

The field should be ploughed second time just before seed sowing in line, and the application of basal dose of chemical fertilizers should be done. Line sowing has an advantage over broadcasting as it requires less seed, facilitates easy weed control and field inspection.

Detail of seed sowing time, amount and method are as follows:

#### Sowing time:

- Generally the time of wheat sowing is during winter or cool season.
- The sowing begins from 1<sup>st</sup> - 2<sup>nd</sup> week of November.

**Amount of sowing seed:**

- About 250 – 300 wheat seeds per square meter land should be sown.
- About 3.5-4 kg seed is required for a Ropani of land (It may vary as per the variety of wheat).

**Method of sowing seed:**

- It is better to sow wheat seeds as:
  - Seed to seed distance: 10 cm.
  - Line to line distance: 25 cm.
- Sow each seeds at 1-1.5 cm depth sowing 2-3 seeds in each spot.
- After sowing the seeds, the soil should be slightly pressed in order to compact the soil. This will help the soil maintain moisture and will enable the seeds to get more water.

**(E) Application of chemical fertilizer**

- The half dose of Urea, full dose of DAP and full dose of Potash should be applied in line and sow seeds in same line.
- The detail amount, time and time of fertilizer application is mentioned on the table below:

**Table No. 6.5.1: Name of fertilizers, amount and timing of application.**

Fertilizers/ Manures	Basic dose (per Ropani)	Top dressing(kg/ Ropani)		Time
		1 <sup>st</sup>	2 <sup>nd</sup>	
Compost/FYM	50-60 bamboo basket (250-300 kg)	-	-	Land preparation (before one month of sowing)
Urea	4 kg	2 kg	2kg	First time: crown root initiation stage(1 month after sowing)  Second time: Plant elongation stage (3 month after sowing)
DAP	5 kg	-	-	2 <sup>nd</sup> ploughing time
Potash	2.0 kg	-	-	2 <sup>nd</sup> ploughing time

Source: JICA Project Team

## 7. Farming Activities during Growth Period

### 7.1 Weeding and Top dressing

- **1<sup>st</sup> weeding and top-dressing**

- Weeding helps to save the unnecessary consumption of micro-nutrients applied for wheat. First weeding should be done 1 month after sowing (at crown root initiation stage). At the same time, first top dressing should also be done right after first weeding.
- We should apply 2 kg of urea per Ropani of land on the row near each plant row as top dressing.

- **2<sup>nd</sup> weeding and top-dressing**

- Second weeding should be done on plant elongation stage after about three month of sowing. At the same time, second top dressing should also be done right after second weeding.
- The amount of urea during second top dressing should be applied as same as 1<sup>st</sup> top dressing.

### 7.2 Irrigation

Irrigation means the providence of water in the field for the plants, due to which the plants get moisture from soil, and we can obtain higher production.

- **1<sup>st</sup> irrigation**

In case, there is no rain until a month after sowing, we should give the irrigation in the field after 20-25 days of sowing during the time of crown root initiation stage.

- **2<sup>nd</sup> irrigation**

If possible, during the time of spike formation (after about 3 and half month), irrigation should be given in the field, which help to produce more grains.

### 7.3 Pressing

Pressing is the process of pressing the plants in the field by the help of cattle with putting net on their mouth or by the help of foot. Pressing helps to increase the number of tillers of plants, and gives higher production.

- **1<sup>st</sup> Pressing**

- Pressing is done in the wheat field for increasing the tiller numbers due to which the production can be increased.



Fig. No. 7.3.1: Pressing the wheat

Source: JICA Project Team



- First pressing is done after 35-40 days of sowing during tiller formation stage.
- **2<sup>nd</sup> pressing**
  - Second pressing is done in wheat field 10-15 days after first pressing at the time of tiller development stage.

#### 7.4 Field inspection

- Field inspection will help to produce high quality seed by controlling disease, pest and maintaining purity.
- The field should be removed of undesirable plants including off-types of genetic variants of the same variety, other varieties of wheat, noxious weeds and infected plants with seed borne diseases.
- This practice is carried out to maintain the genetic purity of the variety, and to keep the seed crop free from seed borne diseases.
- The following types of off-types and diseased pest infected plants should be removed during each field inspection at different stages of plants:



Fig. No. 7.3.1: Technicians together with farmers inspecting wheat field

Source: JICA Project Team

##### (A) 1<sup>st</sup> Field inspection

Tiller development stage (50-60 days after of sowing)

- Check plant height in the field, and remove plant with un-uniform height (so much taller and so much dwarf)
- Check the plants stalk or tillers thickness and remove, which is thinner and thicker in appearance from other majority of plants.
- Check plant in the field and remove plant having leaves with un-uniform colour.

##### (B) 2<sup>nd</sup> Field inspection

Flowering-milking stage (after 4-5 month of sowing)

- Check and remove the plants having too early and too late spike formation.
- Check and remove the plants having too late and too early flower formation in the plants among the whole plants in the field.
- Check and remove the plants having un-uniform plant height. (remove too short and too tall plant)








**(C) 3<sup>rd</sup> Field inspection**

Milking stage-maturity stage (5-6month after sowing)



- Check the field situation and remove the plants having un-uniform ear size, shape and different grains setting density.
- Check the plants in the field and remove the plants having un-uniform Awn (thin threads in spike) i.e. too long awn or too short awn.
- Check the plants in the field and remove those which are too early matured and too late matured.


**8. Major Pest and Diseases in Wheat****8.1 Major pests in wheat**

Pests	Symptoms of damage	Control
 <p>Fig. No. 8.1.1: White Grub</p> <p>Source: Crop Protection Directorate, Harihar Bhawan, Lalitpur</p>	<ul style="list-style-type: none"> <li>• It lives in soil and feed on roots, and the plant dies.</li> </ul>	<ul style="list-style-type: none"> <li>• Ploughing the field and pick up the white grub manually,</li> <li>• Do not use unfermented FYM.</li> <li>• Use <i>Hamal Jhol</i> 1.</li> <li>• In case there is the prevalence of white grub every year, use 2 kg Meterhizium pesticide for per Ropani mixing with soil during second ploughing time.</li> <li>• We also can use Meterhizium mixing with soil in second weeding in highly infected field.</li> </ul>
 <p>Fig. No. 8.1.2: Army worms</p> <p>Source: Crop Protection Directorate, Harihar Bhawan, Lalitpur</p>	<ul style="list-style-type: none"> <li>• The larva of army worms randomly feed on ripe wheat grain and young shoot.</li> <li>• They also eat wheat seeds and leaves as well.</li> <li>• They eat all leaves and make the plant leafless.</li> </ul>	<ul style="list-style-type: none"> <li>• The land should be properly cleaned and ploughed before sowing.</li> <li>• The entire residues left of previous crop should be collected and burnt or buried.</li> <li>• 2 ml of Metacid 50 EC should be mixed with 1 litre water or make the solution of 15 litre mixing 30 ml. of Metacid for 1 Ropani of land and spray in the evening time (army worms usually hide in soil during day, hence, pesticide should be sprayed in the evening time)</li> </ul>

Pests	Symptoms of damage	Control
 <p>Fig. No. 8.1.3: Wire worms</p> <p>Source: Crop Protection Directorate, Harihar Bhawan, Lalitpur</p>	<ul style="list-style-type: none"> <li>• These worms damage root and parts of plant under soil and sometime to the seeds also.</li> </ul>	<ul style="list-style-type: none"> <li>• Adopt crop rotation system</li> <li>• Irrigate the field properly if there is irrigation facility during period of cultivation.</li> </ul>
 <p>Fig. No. 8.1.4: Aphid</p> <p>Source: Crop Protection Directorate, Harihar Bhawan, Lalitpur</p>	<ul style="list-style-type: none"> <li>• These pests cause more damage during the time of spike formation.</li> <li>• They cause serious damage sucking sap from leaves and young spikes.</li> </ul>	<ul style="list-style-type: none"> <li>• Use Dimethoate pesticide at the rate of 1 ml. per litre of water, and spray at the aphid appeared 1 Ropani of field. (Make the solution of 15 litre of water mixing with 15 ml of Dimethoate and spray).</li> </ul>
 <p>Fig. No. 8.1.5: Cut worms</p> <p>Source: Crop Protection Directorate, Harihar Bhawan, Lalitpur</p>	<ul style="list-style-type: none"> <li>• The larvae of this pest feed on stem and leave in night time.</li> </ul>	<ul style="list-style-type: none"> <li>• Spray 1 kg of Dorsban granule per Ropani near each plant during the time of vegetative growth stage.</li> <li>• The weeding and field sanitation should be done for controlling pest in the field.</li> </ul>

## 8.2 Major diseases and their control

Diseases	Symptoms	Control/ Management
 <p>Fig. No. 8.2.1: Yellow rust</p> <p>Source: Crop Protection Directorate, Harihar Bhawan, Lalitpur</p>	<ul style="list-style-type: none"> <li>• Smaller long-type yellow dots appear on upper side of leaves, and the dots make a yellow line on leaves.</li> <li>• This disease also appears on underside of leaf, husk of grain and ear part.</li> <li>• The entire wheat field looks yellow if there is high attack of this disease.</li> </ul>	<ul style="list-style-type: none"> <li>• Cultivate the disease resistant varieties of wheat such as W. K. 1204, Gautam, Danphe Munal, Dhaulagiri etc.</li> <li>• Use only recommended dose of urea.</li> <li>• Spray the Mancozeb (fungicide) solution made by mixing 2.5 gm. in 1 litre water. (Spray 15-20 litre of fungicide water solution with 40-50 gm. of Mancozeb for 1 Ropani of field.)</li> <li>• Spray Propiconazole solution at the rate of 0.75 gm. per litre of water. (Make solution of 15-20 litre water with 11-15 gm. chemical for 1 Ropani of field, and spray it).</li> </ul>
 <p>Fig. No. 8.2.2: Loose smut</p> <p>Source: Crop Protection Directorate, Harihar Bhawan, Lalitpur</p>	<ul style="list-style-type: none"> <li>• The wheat ears are filled with black fungal powder and sometime wind carries away the powders, and remains nude spike only.</li> </ul>	<ul style="list-style-type: none"> <li>• Before sowing the seeds, keep the seeds in cold water for 4 hours, and treat the seed placing in hot water at 52 degree Celsius for 10 minutes or 50 degree Celsius for 5 minutes, and shade dry the seeds for some hours.</li> <li>• Cultivate disease-resistant variety of wheat such as Annapurna – 4.</li> <li>• Treat per kg of seeds before sowing with 2- 3 gram of fungicide such as Vaitavax – 2000, Bevis tine, Benlet, Dorosal, etc. (for 1 Ropani, use 7-10 gm. fungicides for 3.5 kg seed treatment)</li> </ul>

Diseases	Symptoms	Control/ Management
 <p>Fig. No. 8.2.3: Bacterial leaf blight</p> <p>Source: Crop Protection Directorate, Harihar Bhawan, Lalitpur</p>	<ul style="list-style-type: none"> <li>Initially, small brown or black dots appear on leaves.</li> <li>Later on these dots develop into oval shape.</li> <li>The central part of the shape becomes light brown with yellow circle around them.</li> <li>Finally, all dots expand and become like as one and the leaves appeared as burnt.</li> </ul>	<ul style="list-style-type: none"> <li>Cultivate disease-resistant variety of wheat such as <i>Pasang Lhamu</i>, <i>W K 1204</i>, <i>Aaditya</i>, <i>Gautam</i>, <i>Vijaya</i>, etc.</li> <li>Early sowing of seeds somehow help to minimize the infection of this disease. (sowing last of October )</li> <li>Apply the urea, phosphorus, and potash as recommendation amount.</li> <li>Use the seed only after the chemical treatment by Vitavax -200 at the rate of 2-2.5 gm. per kg of seed (7-9 gm. per 3.5 kg of seeds for 1 Ropani of land)</li> </ul>

## 9. Harvesting

### 9.1 Timing of harvest

- When the stem just below the spikes turn yellow from green, it is the signal that the crop is ready for harvest and it is best to cut and collect the wheat crop within 7 days of it. Generally, during the time of harvesting, moisture in wheat seed is around 30%.
- Wheat should be harvested in sunny day. Seed may germinate or rotten during storage in case plant become wet by rainfall.

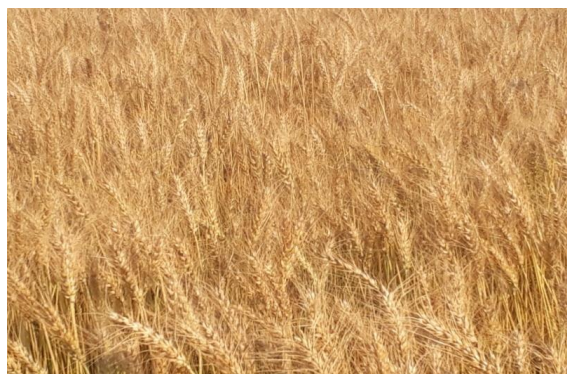


Fig. No. 9.2.1: Wheat ears ready for harvest

Source: Crop Protection Directorate



## 9.2 Method of harvesting

- The stalk is cut about 5-10 cm above the ground or with a stalk length of about 65-75 cm, which is easier for bundling and threshing.



Fig. No. 9.2.2: Wheat harvesting by farmers

Source: Crop Protection Directorate

## 9.3 Threshing

- Beating the cut plants in bundles by manually with stick is also a method of threshing the seeds, but losses of seeds is high by this method.
- Pedal thresher for wheat threshing reduces drudgery. The working capacity of such threshers is 40-50 kg per hours.
- The bundle of wheat can also be threshed beating in slab. This method may damage of wheat as well as the grain remains in wheat ear.

## 10. Post-harvest Processing and Storage

### 10.1 Cleaning the seed

It consists of the separation of undesirable material, such as weeds, straw, chaff, panicle stems, empty grain and damaged grains, sand, rocks, stone, dust, plastic and even metal and greases particles from threshed seeds. We clean the seeds for following advantage.

- To get the quality seed, we need to clean it properly.
- The air fan or wind can be used while cleaning.

#### Winnowing fans

- The seed should be cleaned by using hand operated and power operated winnowing fans.
- After threshing, seed should be cleaned by using these fans.
- Generally, such winnowing fans are available at agriculture machinery shops or agricultural machinery shop in urban areas.

## 10.2 Drying

- Generally during the time of harvesting, moisture content of the fresh seeds is higher (30% around).
- Seeds with high moisture contents have a high respiration rate and are susceptible to attack by micro-organisms, insects and other pests. Therefore, the harvested seeds with high moisture contents must be dried to make 12% moisture for safe storage or at least dry until moisture content drops to 18% for temporary storage of 2 weeks when there is not possibility quick drying of seeds.
- The main constraint of sun-drying is the dependence on good weather conditions.
- Losses in wheat products or seeds is main problem arose by bad drying practice. Therefore, good drying practice is crucial for minimizing post-harvest losses, since it directly affects safe storage of seeds.

## 10.3 Storing seeds in storage

- Seed storage refers act of keeping the seeds safe during the storage time until the seeds are sown or marketed.
- Seeds should be very carefully handled and stored without contamination from other variety and other crop seeds.
- The storage also should protect the seeds from pests and rodents which eat or damage the wheat seeds.
- The wheat seed should be stored without mixing with other variety and seed of other crops.

### (A) Moisture management

If the moisture in seed is more than 12 % at the time of storage, the level of both heat and water increases, and intensify respiration in seeds is also creased. In this condition, the risk of fungal disease, pest and other disease attack increases and reduce the quality of seeds. Likewise, seed should be stored in proper moisture. The following measures can be adopted to manage moisture in seeds:

- The seeds should be stored only after drying them in the sun for 4 – 5 times.
- The seeds should be cleaned before loading into the store container/sacks.

**Table No. 10.3.1: Moisture contents and storage duration**

Moisture contents of seeds	Storage duration
10-12%	For 8-12 months
< 9%	For more than 1 year



**(B) Storage management**

- There should be only one door or opening (not more doors or windows) in the seed storage to maintain the temperature and to protect from the rodents and robbery.
- While storing seeds in sack or metal container, such sacks or containers should be kept above the floor on a raised plank and without leaning the wall.
- The storage structure must protect the wheat seeds from extreme heat or cold and moisture which causes microbial and fungal growth; and also from pests and rodents which consume or damage the wheat seed. So, these points should be considered while storing the wheat seed.



Fig. No. 10.3.1: Wheat stored in sacks

Source: Crop Development Directorate

**(C) Pest and rodents control in storage**

- The store should be cleaned properly before storing the seeds and after the seed are sold out.
- Use fumigants pesticide like Aluminium phosphate or Methyl bromide at the rate of 3 tablets of each 3 gm per ton (1000 kg) of stored seed for fumigation of the storage to control form the moths, mites and other storage pests.
- Fumigation by pesticides in the storage should be done by keeping the fumigants in the centre of storage and let fumigation inside by closing all doors and windows for at least 24 hours during storage and before storage period.
- The place for storage should be clean and safe from pests and mice.
- Use mouse trap in the storage to protect seeds from mice attack.
- Inspect the storage regularly to ensure occurrence of pests.
- Do not keep door of storage open for a long time for controlling birds, rodents and insect attack.
- For weevil, one Sulphas tablet can be used for 100 kg seeds by wrapping in cotton cloth and placing it in the centre of the normal sack / metal bin filled with seed.

**(D) Packing material and method**

- Seed should be packed and stored on sunny day after well drying in sun for 4-5 times.
- To store the seeds, the seeds should be properly dried before the monsoon begins and stored in metal bin, hermetic bag or plastic sack. The bag or sack should be fastened air tight in order to protect seeds from possible moisture.
- Super-grain bag refers to the bag in which insects cannot enter easily and it is air tight. Even if the insects enter into the bag, the insects and fungus die due to treatments done for such bag. The following ways can be followed to use super-grain bags:
  - Squeeze the air out of the bag after placing the seeds inside the bag.
  - Keep the bags binding it in two places and fastening properly after the air inside is squeezed out.
  - The pests can be controlled without using any chemical pesticides.

## **B) Management Aspects for Quality Seed Production**

### **11. Necessity of Management by Seed Production Cooperative**

Production of seeds for commercial sales needs to be done in a certain scale in order to meet the demands of the buyers and to be able to provide stable supply. When a part of the production is affected by diseases or pests, this must be substituted by seeds produced in other plots; otherwise, the buyers will not be able to rely on the producers for stable supply. This may be quite difficult for a single farmer to manage; and therefore, it is encouraged that seed production should be done through seed production cooperatives.

### **12. Structure and Roles of Seed Production Cooperative**

The prime objective of the seed production cooperatives shall be marketing and sales of the produced seeds, as well as its overall quality control. That's why, the cooperative should also function as a liaison body with external organizations such as DADO and Regional Seed Production Laboratory in order to request for technical support or official seed laboratory testing. Furthermore, the cooperative can also work on developing the capacity of its member farmers in order to further enhance the production and quality of seeds.

The major responsibilities of the cooperative in seed production are expected as follows:

- To bear the risk and accountability of produced seed and seed production work.
- To formulate rules and regulations, approve and implement them for quality seed production.
- To keep records of seed production works, and inform the group / members as per the need.
- To expand seed production selecting possible area for quality seed production.
- To supervise the routine works such as use of manure and pesticides, weeding and irrigation management, harvest time, drying out, cleaning, storing and treatment for seeds according to the advice from Technical/ District Agriculture Development Office.
- To observe crop, hold meetings and exchange information and initiate process to address the problems.
- To promote technical skill and knowledge of seed production.
- To coordinate and collaborate with District Agriculture Development Office, District Cooperative Association, and various other seed production organizations.
- To facilitate in laboratory testing, processing, storing, packaging, certification and marketing of the produced seeds.
- To work as a mediator among the District Agriculture Development Office/ Seed trader and seed production sub-group.
- To extend the seed production extending the potential seed production area.

Furthermore, seed production groups shall be formulated by dividing the member farmers by the location of their farmlands, in order to effectively manage the seed quality. Each group

shall also select one coordinator to link the group members with the cooperative. The major roles and responsibilities of the group coordinator shall be as follows:

- To maintain regular communication, coordination and cooperation with cooperative.
- To work as a mediator between farmers and cooperative.
- To inspect crops time to time coordinating among inter-groups.
- To report problems seen in seed production to the cooperative, and take necessary initiative for solution.
- To treat all members equally.
- To inform all members about any information received from the cooperative or any other bodies or organizations.
- To participate or make arrangement for other members to participate in seminars in turn.
- To utilize received support or materials for the benefits of all, manage them properly or get them managed.
- To take mutual and consensual decisions, or help to that end.
- To get committed for producing quality seeds.

*The organizational structure of the suggested Seed Production Cooperative is indicated in the following figure*

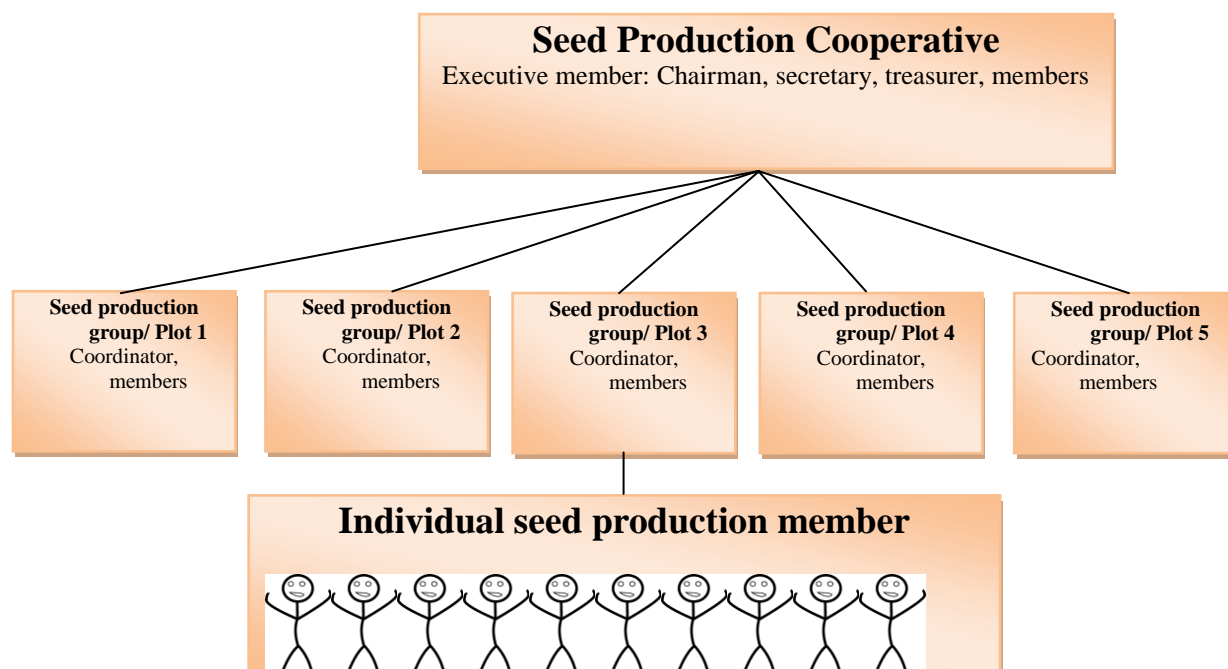


Fig. No. 12.1 Structure of suggested seed production cooperative

Source: JICA Project Team

### **13. Major Actions to Be Taken by Seed Production Cooperative**

The followings indicate the major actions to be taken by the seed production cooperative.

#### **13.1 Land and variety selection**

The variety and amount of seed have to be planed and produced in consultation with DADO, in consideration of market demand.

- Cooperative needs to select appropriate seed variety based on the climatic and geographical conditions in coordination with the respective District Agriculture Development Office.
- The cooperative shall not change the seed variety every year in the production area to avoid contamination with other previous variety.
- Land plot has to be selected through discussion with member farmers and respective DADO in consideration of the following points:
  - If seeds of different variety have to be produced under a single cooperative, the production area should be divided into separate plots to minimize chances of getting mixed different seed varieties, while producing quality seeds.
  - Trustworthy farmers and separate fields with isolation distance should be selected by coordinating with the concerned farmers to produce quality seed by cooperative.
  - Separation of plots for food crop and seed crop can be done on the basis of trail/ roads, water cannel or forest, etc.
  - In case, seed crop and food crop are to be grown at the same area at the same period, the crop variety should be same.

#### **13.2 Quality control and record keeping**

##### **(A) Record keeping**

- To ensure the seed quality, it is very important to record the process of seed production management (field inspection form) of production area, every stage of crop development, and keep all records of produced seeds including laboratory certificates.
- Also, keep complete records of seed produced by all farmer members after the harvest.

##### **(B) Preserve seed from mixing and infection**

- Preserve seed from getting crossed with other variety while harvesting and storing. Even for cultivating food crop around seed production area, same variety of crop should be cultivated. However, such crops would be better to cultivate at the difference of 1 month.

**(C) Prediction of disease and pest attack**

- Predicting the possible attack from disease and pest at the early stage of crops, in consultation with the District Agriculture Development office or related governmental offices, the outbreak of disease and pest attack can be easily and effectively controlled using necessary pesticide at the right time.

**(D) Regular inspection of field**

- It is very important for the farmers, seed production group and cooperative to pay attention and keep records of genetic quality of crop, condition of weeds, and infection from disease and pests, etc., during regular field inspection and management of crop. The frequency and contents of regular inspection are indicated in the following table.

**Table No. 13.2.1****Frequency and contents of field inspection by Cooperative and Group**

<b>Responsible sides for seed production</b>	<b>Inspection Time</b>	<b>Inspection Work</b>
Seed production Cooperative	At least twice a month	Inspect of proper spacing, crossing with other varieties, outbreak of disease and pest, weeds and height situation etc., and provide necessary advices to farmers accordingly for controlling measures, and keeping records of it.
Seed production sub-group	At least fourth a month	Weeds, equal height, outbreak of disease and pest, and provide necessary advices to farmers and cooperative accordingly for controlling measures, and keeping records of it.

Source: JICA Project Team



**(E) Coordination with DADO/Regional Seed Production Laboratory or other related governmental authorities for field inspection**

Coordination shall be made with DADO/Regional Seed Production Laboratory or other related governmental authorities to conduct official field inspections as indicated in the following:

**Table No. 13.2.2**

**Timing of official field inspection**

Crop name	Field inspection Time		Activities
	First	Second	
Wheat	Time of spike formation	Grain ripening time	<u>Uproot and Remove:</u> disease plants Early or late spike formatted plant Plant with different spike, colour, size, length, grain numbers etc.

Source: Seed production and management training booklet, 2069 B.S., [www.sqcc.gov.np](http://www.sqcc.gov.np)

The acceptable standards for official field inspection are as follows:

**Table No. 13.2.3**

**Minimum standard of certified seed crop to be checked  
During Official Field Inspection**

Name of Crop	Minimum Isolation distance (in meter)	Maximum Off-type plants percentage	Maximum diseased plant in percentage	Restricted disease
Wheat	3	0.30	0.50	Loose smut

Source: Seed production and management training booklet, 2069 B.S., [www.sqcc.gov.np](http://www.sqcc.gov.np)

### **13.3 Collection of produced seeds and storage**

#### **(A) Germination test**

- After harvesting the seeds about 2 to 3 months, conduct germination test as indicated in **“6.3 Germination test”**.
- The coordinator of each group shall collect samples from individual farmer, and conduct germination test based on the procedures indicated in **“6.3 Germination test”**.
- If the result of the germination test is below 85%, the seeds will be returned to the respective farmer. The farmer shall once again clean the seeds and submit it to the coordinator. This process shall be continued until the germination rate becomes 85% or above. If the germination rate does not reach 85% after several times of cleaning, the coordinator shall reject the seeds, and the farmer shall use them for self-consumption or sales as food-crop.
- It should also be noted that germination of seeds is affected by low temperature. Therefore, when conducting germination test, temperature of the container should be 25-30 °C.
- This process should be conducted with extra care; because if the reliability of the germination test at this point is low, it will affect the seed quality of the entire lot, which will lead to lower the income of the whole seed production group.
- After confirming that the seeds have germination rate of 85% or above, the coordinator shall submit the record of final germination tests for each farmer to the cooperative. The record shall consist of; name of farmer, type and variety of crop, period of germination test, and germination rate.

#### **(B) Collection of produced seeds and storage**

- After receiving the final result of the germination tests from the group coordinator, the cooperative shall collect the seeds from the group.
- The certificate provided by regional lab is mandatory before marketing of seeds.
- The seeds collected from the individual subgroups shall be managed as one “lot”, which should not be mixed with seeds from other sub-groups.
- The seeds should be mixed together with same lot in clean and open space. But, it should be ensured that the place is clean before and after mixing the seed to each other, so that it should be protected to mix with dust and other seeds.
- After mixing, the seeds shall be packed in super grain bags or tight metal bins with one Selphas tablet for 100kg seeds wrapped in cotton cloth in the centre of the bag/bin. An identical tag indicating the lot number, name of crop, variety of seed, production year and date of packing shall be placed in a visible location on each bag/bin.

- The bags/bins shall be stored as described in “(B) Storage management” of “10.3 Storing seed in storage” with due attention that it will not be mixed with seeds from other lots.

#### (C) Coordination for official germination test

- The cooperative shall collect samples from each lot, and submit them to DADO or Regional Seed Production Laboratory for official lab testing.
- The standards for certified seeds are as indicated in the following table.

### 13.4 Standard for seed certification

Table No. 13.4.1

#### Acceptable and unacceptable standard in seed inspection for certified seed

Crop name	Min. Physical Purity (%)	Max. next mater (%)	Max. other crop seed (grains per Kg)	Max. seeds of restricted weeds (grain per kg)	Max. identifiable other variety seeds (grains per Kg)	Min. germination rate (%)	Max. Moisture percentage (%)
Wheat	98	2	20	5	20	85	12

Source: Seed production and management training booklet, 2069 B.S.,  
www.sqcc.gov.np

- After receiving the results of the official germination test, the result should be recorded together with the amount of seed collected in each lot. Furthermore, the following information should be additionally indicated on the bag/bin of seed for each lot.
  - Purity Percentage
  - Germinating percentage
  - Month of seed testing

### 13.5 Packaging

- After receiving the certificate, seeds should be kept in clean and attractive bags. According to consumers' choice, seeds can be packed in plastic bags or sacks of different sizes and sent to the market.

### 13.6 Warranty tag

- In the form received from Agriculture Development Office required details should be carefully filled up on the basis of laboratory testing certificate.
  - Name of Crop

- Name of variety
  - Tag number
  - Lot number
  - Production Year
  - Physical Purity Percentage
  - Moisture percentage
  - Germinating percentage
  - Seed weight
  - Date of seed testing
  - Name of cooperative
  - Address of cooperative
  - Treated chemical name
- Validity period of seed laboratory testing results provided by seed testing laboratories is only up to six months from the time of testing, and retesting is required if entrepreneurs want to sell that seed after six month duration. (Seed Act, 1988)
  - Warranty tag should be kept inside plastic, and it should be stitched placing visible in middle part of the open end of the bag.
  - While stitching bag together with the form, details of the form should be visible.

Fig. No. 13.6.1 Sample tag

Source: JICA Project Team

Fig. No. 13.6.2 Stitched sample tag in seed bag

Source: JICA Project Team

### **13.7 Advertisement and sales**

- Promotion can be done disseminating information about quality seeds through the local medias such as local newspapers, Radio, etc. which help in the sale of seeds in the local market itself.
- Marketing for seeds can be done in collaboration with District Agriculture Development Office and Private companies for selling seeds or signing an agreement with them.
- After Marketing of seeds, the benefit shall be distributed to the individual farmers after retaining a certain amount for logistic costs for the seed production group / cooperative. The amount to be retained shall be decided and agreed by the members prior to the handing over to the seed production group / cooperative.

### **14. Skilled Human Resource Development under Seed Production Group and Cooperatives for the Quality Seed Production**

In order to further enhance the amount and quality of seeds produced by its members, the cooperative shall further coordinate with DADO and its Service Centres to receive technical information and trainings for its core members including the coordinators of each group. The knowledge gained shall be further disseminated to all members through the coordinators.



# Compost



## **PART 1: Farm Yard Manure (FYM)**

### **1. Introduction**

Generally Nepalese farmers have the practice of collecting FYM from their livestock shed as an organic fertilizer for their crop fields.

Farm Yard Manure is the manure prepared in decomposed from by collecting dung and urine of farm animals along with wastes feeds, fodder, and the bedding materials. FYM is the main organic manure used in Nepal.

However, Nepalese farmers have the practice of applying immature (un-decomposed) FYM in their field. Immature manure FYM can cause the generation of harmful gas ammonia and wilting, and disturb for well germination of seeds. And, also the immature (un-decomposed) manure does not improve soil conditioning capacity of increasing water holding and fertilizer holding ability. Weed seeds can also survive inside manure and as a result, weeds problems occur in the field.

Well decomposed FYM can solve many crop growth problems in the fields.

### **2. Advantages of Well Decomposed Farm Yard Manure (FYM)**

#### **2.1 Improvement of soil productivity**

- Application of well decomposed FYM in soil act as a soil conditioner which is capable of improving moisture holding, fertilizers holding and air passing capacity; as well as it helps the capacity of drainage to soil in good balance. This type of soil is very useful for good growth and development of plants.
- By the application of well decomposed FYM, some portions of nutrients are available directly to the plants and remaining nutrients in soil is released to plants for long time.
- The materials that soak urine should be used as bedding materials in animal shed which can help to minimize the loss of urine. Otherwise, we can also make the urine collecting place separately with plastic or cemented structure, and use urine as fertilizers.
- By using well decomposed FYM in field, fewer amounts of chemical fertilizers are also enough for crop, which can also save the money.

**Table No. 2.1 Composition of FYM**

<b>Materials</b>	<b>Nitrogen (%)</b>	<b>Phosphorus (%)</b>	<b>Potash (%)</b>
Paddy straw	0.42	0.20	0.45
Cow dung	0.71	0.70	0.74
Pig faeces	1.35	1.94	1.05

Source: Ministry of Agriculture, Forestry and Fisheries, Japan 2000

## **2.2 Healthy for plants**

- Well decomposed FYM is free from weed seeds; plant pathogenic Fungi, bacteria and parasites.
- Around temperatures of 55 °C to 65 °C during decomposition, many microorganisms, plant pathogenic fungi, bacteria and parasites are destroyed.

## **2.3 Good means of breakdown of organic matter**

- FYM is the good means of breakdown of organic matter in simpler form
- During decomposition of FYM, high temperature inside is accelerated, which helps to breakdown of structural molecules of bedding materials (straw, weed, grasses of feed, etc.) into simpler nutrient form which can be easily uptake by plant after its application.

## **3. Material Required for Making FYM**

- Animal excreta: Dung, Urine
- Bedding materials: Straw, saw dust, dry leaves etc.

## **4. The Place for Making FYM**

Place for collecting and making decomposed FYM should be as followings:

- The nearer place to animal shed
- Elevated and well drained place
- Place of easy care and observation

- It is recommended two places for the preparation of well decomposed FYM manure. Therefore total two place should be selected as mentioned below:

- First storage place
- Second storage place

#### **(A) First storage place**

- Every day animal dung, urine and bedding materials should be collected on the surface near the animal shed.
- Usually pits of 8 meters length x 2 meters wide x 1 meter depth dimensions should be prepared nearby the animal shed, but the dimension may varies according to the land availability and number of animals.



Fig. No. 4.1 Taking out Farm Yard Manure

Source: JICA Project Team

- After putting the manure (Dung together with bedding materials) from animals shed in first place up to 2 months, let it remain further up to 2 months without putting other manures over it. And at that time of collecting the manure to be done in the second storage place.

#### **(B) Second storage place for preparation of decomposed FYM**

- After 2 months of manure collection in first place, use second place to collect manures from animal shed.
- Collect the manure in second place daily up to 2 months as first one. And, let it remain for next 2 months without collecting the manures over that for further decomposing.
- The size of second storage place can be varied according to the land availability



Fig. No. 4.2 FYM with roofing

Source: JICA Project Team

- If possible, storage place for collecting manure should be walled and roofed with stone, wood, or hay, which protects manure from direct sunlight and rain. It is important to protect manure from sunlight and rain to protect micronutrients; otherwise the micronutrients in the manure will be lost.

### **(C) Actual Procedure for collecting and using FYM**

- The fresh dung together with bedding materials should be collected daily from animal sheds to the first storage place up to 2 months properly, and let it remains for next 2 month by covering it with dry leaves, straw or plastic sheet.
- After fulfilling the manure in first storage place, the manures should be collected daily to the next storage place.
- Put the manure in next storage up to 2 months and cover it like as in first place, and let it remains for next two months.
- The manure already becomes fermented in first place up to two months, when we are collecting dung in second place. So, we can apply the manure from first place to the field, and the first place will become empty and we can collect the dung again on first place. This cycle continue on every two month period on first and second places. This way, we can get well fermented FYM.

## **5. Condition Required for Well Decomposition of FYM**

Well decomposition of manure is required for making good FYM. For making well decomposed manure, the following things should be considered well during its preparation:

- After piled up the fresh FYM, moisture content of the FYM should be managed 50-65%. It can be known by squeezing the manure in palm of hand, if it is wet. If moisture is less, water should be sprayed, and if moisture is high, the manures should be dried in shadow by removing cover for 1-2 days.
- The fresh FYM temperature rises up to 70 degrees Celsius within 2 to 3 weeks (1 week in summer) after deposition, which is not good for well decomposition of FYM. Therefore, we should be careful for turning over at every 60 °C for two to three times. It can be known by putting hand inside the manure and feel hot.

- The manure has to be covered with a plastic sheet or straw or dried leaves or mud to protect rain and direct sunlight.
- FYM will be ready to use from first place after 2 months of filling it.

## 6. Collection of Animal Urine and Its Advantages

### 6.1 Collection of urine

- Urine can also be collected and preserved for separate use or for mixing in manure by following method:
  - The floor of cattle shed should be cemented to collect urine.
  - To collect the urine, cemented tank should be constructed at first; and then urine could be collected in plastic tank.
  - By making a pit in a corner of the shed, urine can also be collected

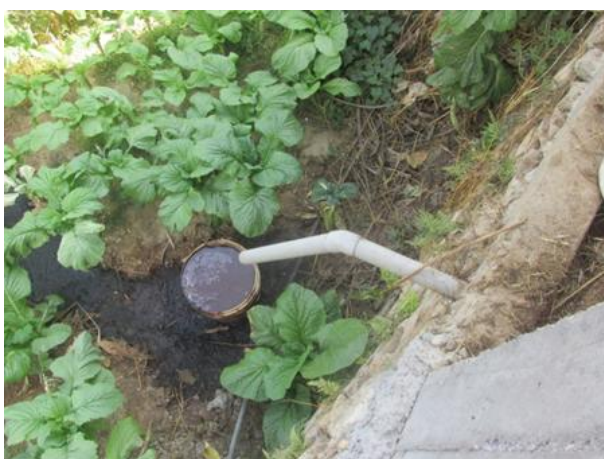


Fig. No. 6.1.1 Cattle urine collection through pipe from shed

Source: JICA Project Team



Fig. No. 6.1.2 Cattle urine collection through drain

Source: JICA Project Team

### 6.2 Advantage of collecting urine

- The urine can be collected separately, and used as fertilizer since it has three times more nitrogen than in dung.
- Urine also can be used to control the disease and pests in crops. This can be sprayed in 5 to 7 days gap by mixing 1 part of urine with 4-5 parts of water.
- It also helps to reduce the application of chemical fertilizer and pesticide, which leads to reducing production cost.



- Separate collection of urine will help to sanitize and dry animal shed.
- The urine can be used together with water as fertilizer.

### 7. Things to Be Considered While Making Farm Yard Manure (FYM)

- The FYM should not be dried under the sun to decrease its weight, which will cause the loss of nutrients.
- The FYM should not be left on field in small heaps for long time as the nutrients will be lost.
- Instead of leaving the FYM in individual heaps, it would be better 4 to 5 bamboo baskets of manure collection in one heap, and covered with straw, dried leaves, plastic, etc., which will help to protect the nutrients.

#### Some photographs of wrong and good practices



Fig. No. 7.1 Manure dried in the sun  
(Bad practice)

Source: JICA Project Team



Fig. No. 7.2 Small heap of manure in the field  
(Bad practice)

Source: JICA Project Team





Fig. No 7.3 Collection of 4-5 bamboo baskets of FYM in one place, and covered by dried leaves (Good practice)

Source: JICA Project Team

## **PART 2: COMPOST MANURE**

### **8. Introduction**

- Compost manure can be prepared as alternative to FYM.
- Compost making is the best option for the farmers who don't rear the animals or cattle's with them.
- Compost manure is decomposed mixture of straws, grasses, fodder, ash, leaves and other parts of trees, farm waste, kitchen waste and similar material, together with dung if possible.
- Compost manure is generally prepared in pit or heap by making different layers of raw materials covering with mud or plastic. One wooden stake or bamboo is put in the middle for well development of bacteria and to be decomposed.
- The temperature inside the manure should be felt hot. While we put our hand inside the manures, the temperature is up to 50-60 °C at that time.
- Emulsifying concentrate (E. M.) should be sprayed in each layer of the grasses or straw or other raw materials during the preparation of manure for quick decomposition of the manure.

## **9. The Advantages of the Compost Manure**

- It provides necessary nutrients to the soil for improving its fertility.
- Increases the water absorbing capacity of soil.
- Improves the physical, chemical and biological quality of soil.
- Increase air aeration and water movement in the soil.
- Manure can be kept in soil for long time.
- Increases the microbial activity in the soil; due to which soil become soft, and increase fertility status in the soil.
- Compost manure can be prepared in own accessible places, so that it will be easy for carrying manure in the field.

## **10. The Materials Required for Making Compost Manure**

- Waste straws and grasses.
- Weeds, leaves fallen from trees.
- Roots and stems of young plants.
- Dung and urine of animals.
- Organic kitchen product ( vegetable, food wastes)
- Limestone, ash, urea, etc.

## **11. The Place for Making Compost Manure**

- The near place from farm.
- Elevated and well drained place
- Place of easy care and observation.

## **12. Methods of Preparing Compost Manure**

### **12.1 Methods of preparing compost in pit**

#### **(A) Digging pit**

- It is better to dig a pit on winter season than in summer season due to which the chance of drying out of material is less.

- The length of the pit should be as per need, but depth should not be more than one meter.

### **(B) Filling pit**

- The collected raw materials for making compost manure should be kept arranging in layers inside the pit.
- Wooden stick or a bamboo should be put in the middle of the pit during filling materials inside the pit.
- Spraying water in each layer of compost during its preparation will help for making good compost manure.
- It is better to make each layer up to 15-20 cm (1 to 1.5 hand span).
- We can also use dried leaves, green fodder, dung, water (2-3 litre of water in each layer), lime powder (100-200 gm. in each layer), *E. M. liquid* (Mixture of 1 litre E.M. and 10-15 litre water, and spray nearly 1 litre in each layer) and forest soil (2-3 kg. in each layer) between each layer which help to decompose the manure well.
- E.M. liquid, Dung, Urine, lime powder is not mandatory, but it is better to apply for producing well decomposed FYM.
- Lime powder preserves the manure from its acidity and increases the bacterial activities. Likewise, forest soil increases the bacterial numbers.
- The use of dung and urine between the raw materials will increase the quality of the compost.
- The raw materials should be forcefully pressed inside the pit so that it decays soon.

### **(C) Using bamboo or wood stake for manure ventilation**

- During the winter and dry summer, the compost should be prepared by pit method due to which the moisture can be preserved inside the pit.
- In case the temperature inside the compost become so much hot (over than 70 °C), bacteria cannot be survived and that will damage the compost, which will give the

less quality of compost. Therefore, to maintain the temperature only up to 60 °C, bamboo or wooden stake should be put during the time of compost preparation.

- The bamboo or wooden stake should be swing or stirred round by hand in every week for maintaining the temperature and passing air inside the manure, which will give well decomposed compost manure after 3-4 month.

#### **(D) Covering by mud or plastic**

- After filling up the materials the pit should be covered with mud.
- Covering the pit with mud stops the spread of bad smell and preserves manure from rain, direct sun-light and from nutrient loss.

*Methods of producing compost by digging pit have been presented as followings:*



Fig. No. 12.1.1 Digging a pit for preparing Compost Manure



Fig. No. 12.1.2 Taking out soil from pit



Fig. No. 12.1.3 Pit ready for putting compost making materials



Fig. No. 12.1.4 Putting raw materials for compost making





Fig. No. 12.1.5 Pressing the raw materials with staking in the middle part to prepare manure



Fig. No. 12.1.6 Spraying the water for compost making



Fig. No 12.1.7 Covering with plastic to decompose the materials for compost manure



Fig. No. 12.1.8 Observing well decomposed compost manure



Fig. No. 12.1.9 Observing the condition of manure while turn-over of compost



Fig. No 12.1.10 Farmer applying well decomposed compost manure in rows

Source: JICA Project Team

## 12.2 Heap method

### (A) Methods of making compost in heap

- Compost manure also can be produced by making heap on earth surface without digging a pit. The heap method of compost making is done in rainy season due to which the manure cannot be damaged by excessive moisture.
- It is better to make a heap in slightly elevated, and drainage facilitated site.
- This method of making compost is better in the area where shortage of labour and time.

### (B) Methods of making heaps on earth surface to produce compost manure

The following methods should be applied for making the compost by heap method:

- Put fodder, weeds, grasses, straws, hey and leaves on earth surface in different layer by making heap.
- Make the different layers of straw, leaves, branches, fodders or grasses by putting dung or lime or soil in between each layer, and spray water together with E.M. liquid.
- The materials in heap should be tightly pressed so that it gets decomposed earlier.

### (C) Use of wooden or Bamboo frame for making compost on heap

- Heaps of material can be put inside the wooden frame or covering around by wooden stakes or bamboo stakes.
- The wooden or bamboo frame can be made as per desire, but the height should be 1-1.3 meter height.

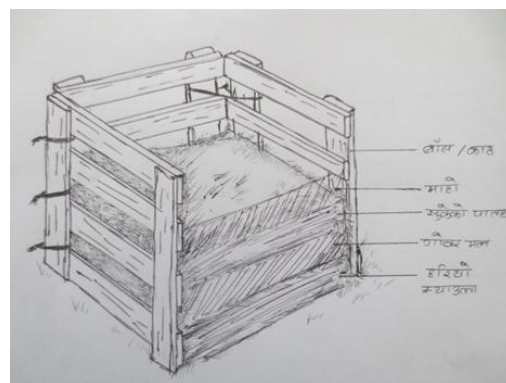


Fig. No. 12.2.1 Wooden or bamboo frame for making compost by heap method

Source: JICA Project Team



**(D) Turn-over in heap method for compost making**

- Generally, the turn-over of compost should be done when the temperature inside the compost is 60-65 °C, which is identified by feeling very hot while we put hand up to 20 cm inside the compost.
- In case the temperature inside the compost become so much hot (over than 70 °C), bacteria cannot be survived, and that will damage the compost, which will give the less quality compost. Therefore turn-over should be done on-time.
- Making another frame near the main frame will help to exchange the manure for controlling the excessive heat inside the compost, and for turnover of compost for obtaining well decomposed manure.

**(E) The timing of turn-over**

Compost manure should be turned over when its temperature becomes near 60 °C, which can be identified by putting your hand inside, and feels very hot. Thus, temperature should be checked every week.

**13. Identifying the Well Decomposed Compost and FYM**

- The manure is decayed and appears black.
- The used materials loses its original form, and cannot be distinguished
- The manure does not stick in hand.
- The bad smell of manure is less.

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