COURSE GUIDE

CRP 503
SEED PRODUCTION TECHNOLOGY

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UNIT 1 ECONOMIC JUSTIFICATION FOR A SEED PROGRAMME

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1.0 INTRODUCTION

Seed is the bedrock on which every successful agricultural or crop production programme is built but not much attention was paid to seed studies until recently. More attention in the recent past was paid to other agronomic practices like tillage operations, nutrient requirements, weed and other pest control practices while seed was neglected. Now that seed has gained prominence as an important area of study in agriculture, there is need to explain the benefits that can be derived from the establishment of a seed programme.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain why seed is an important tool in agriculture
- state the benefits derived from seed programmes.

3.0 MAIN CONTENT

3.1 Seed Quality

The main purpose of formulating a seed programme for the country is to ensure:

- Availability of high quality seed to farmers for planting.
- Increase in yield
- Country to be self-sufficient in food production
- Improves farmers' income

A well-developed seed programme could contribute positively to foreign exchange earnings by:

- Exporting seed to other countries
- Provide currency for the importation of other goods that are not available internally.
- Capability to screen incoming foreign seeds to guide against introduction of diseases and pests
- Strengthening of Research
- Aid in diffusion of improved seeds
- Provide employment

SELF-ASSESSTMENT EXERCISE

Assume that you have been appointed Minister of Agriculture of your country, how would you convince your fellow members of cabinet to approve the establishment of a seed programme for the country?

4.0 CONCLUSION

Seed programme is essential in any country to provide good quality seed to farmers for planting to ensure self-reliance and food security.

5.0 SUMMARY

Establishment of a seed programme is an expensive venture, however it provides benefits (food, foreign exchange, varieties of crops, employment) which usually offset any huge investment made. Seed unit establishment is either by the Government or private enterprise.

6.0 TUTOR-MARKED ASSIGNMENT

Assume that you have been appointed Minister of Agriculture of your country, how would you convince your fellow members of cabinet to approve the establishment of a seed programme for the country?

7.0 REFERENCE/FURTHER READING

Adamu, A. et al. (1999). Seed Technology. A Manual for Varietal Maintenance and Breeder and Foundation Seed Production. Ibadan: African Book builders Ltd.

UNIT 2 HISTORY AND STATUS OF SEED INDUSTRY DEVELOPMENT IN NIGERIA

CONTENTS

1.0 INTRODUCTION

Not until recently, many farmers in Nigeria and in many other developing nations could not distinguish between a seed and a grain. The usual habit was to reserve grains with good appearance and natural robustness from farmers harvest as seed for next season planting. The awareness that a seed is a living being was lacking and so selected grains to be used as seed were stored under the same environmental conditions with the grains. Survival of the seeds was therefore dependent upon the nature of protective mechanism the seeds were naturally endowed with. Those with hard seed coat that offer excellent protection to the embryo survived while the others died off. There were no conscious seed production practices. Seeds that were selected from grains are planted to produce food, feed and raw materials for industries. Whenever a need arose to purchase seeds, the usual practice was to look for grains with good appearance in the open market. F.A.O. report (1988), estimated the value of seed sold commercially in developing countries to be 3.8 billion dollars representing about 10 – 12% of global commercial sale.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- describe historical account of the Nigerian farmers' concept and attitude to seed
- appreciate the efforts made by Government and other private organisations to develop seed programme.

3.0 MAIN CONTENT

The Federal Government of Nigeria realising the importance of seed and the need for an efficient seed system approached the FAO of the United Nations in 1974 for technical assistance for establishment of a Seed

Service in Nigeria. By 1975, Nigeria established the National Seed Service (NSS) which is now known as the National Agricultural Seeds Council (NASC). From 1975 to 1980, the UNDP facilitated the development in production and quality control of food crop seed. From 1981-1985, the Federal Government funded a programme under the unilateral Trust Fund Arrangement which showed the importance of improved seed products to Nigerians.

With the co-operation from F.A.O, the Federal Department of Agriculture was able to install seed processing and testing facilities in Ibadan and Samaru Zaria between 1975 – 1980.

With these efforts in place, awareness about the benefits accruing from the use of good quality seeds gradually continued to increase among the Nigerian farmers. This awareness grew with a corresponding increase in the demand for improved seeds. The inability of the Public sector seed agencies only to satisfy the increasing demand for improved seeds triggered the formulation of the first privately owned Nigerian Seed Company known as Agricultural Seeds Limited Zaria, Kaduna State in 1985. The defunct Agricultural Seeds Ltd was an arm of A.G. Leventis. Next was Parental Line Seeds Limited at Otta, Ogun State owned by Obasanjo Farms. This was followed by Temperance Limited between 1985 – 1986, Total Agric. Limited and Top Seeds Limited in 1987. Greenland Farms Limited Egbe in 1988, UAC Agro-industries Kindandan Zaria in 1989 and Pioneer Hi-breed Limited in 1991.

The entry of private seed companies into the seed industry in Nigeria brought about a more aggressive seed certification and quality control scheme which was urgently required to officially inspect and monitor seed quality at all stages of production. One seed certification officer was assigned in each state to carry out seed certification activities. Four seed testing laboratories were established in the country with one central seed testing laboratory at Abuja.

By 1989, the NASC had fully started the production and distribution of improved seeds to state seed agencies for onward multiplication and distribution to farmers. There was therefore now awareness among Nigerian farmers about the benefits of using improved seed. The need for expansion of the seed industry in Nigeria resulted in the receipt of assistance from the World Bank for the establishment of the National Seed and Plant Quarantine Project in 1991.

All these developmental strata's in the seed industry operated fully within a few years of establishment. Already, multiplication of foundation seeds by State Agricultural Development Projects (ADP'S) for distribution to farmers is no longer operational in some states. The state seed

certification officers have been rendered redundant and in some state re-assigned to other duties.

From 1988 – 1989 which was the final phase of the programme, the NASC enjoyed another technical assistance from F.A.O/UNDP on the improvement of the quality of seed where facilities for seed certification were upgraded through the provision of working facilities, equipment and training of laboratory staff. An independent seed certification and quality control scheme was established within the NASC for seed certification.

The state seed system also took off simultaneously with the development of NASC. Each state evolved a state seed multiplication unit which produces certified seeds for its farmers from foundation seed obtained from the NASC. In fact, the sustainability of the efforts investment is under high threat and immediate resuscitation steps are required from both Government and private agencies to prevent the seed industry in Nigeria from eminent collapse. By 1994 only three out of the eight private seed companies that were first established were still operational. Below is a table of private seed companies in Nigeria and their operational status as at 1994.

Table 1: Private seed companies in Nigeria and their status as at 1994

S/No.	Name of Company	Location	Year Established	Activity	Status
1.	Agricultural Seeds Ltd. Agseed	Zaria Kaduna	1984	**Research** production and marketing of hybrid and O P maize and varieties of sorghum, cowpea, soybeans, cotton, rice	Closed operation in 1992 and sold the assets to Pioneer Hi-Breed Seed Nig. Ltd.
2.	Parental Line Seeds Ltd. (Temperance Seeds Ltd,)	Otta/Abeokuta	1985	Production and marketing maize hybrids and O P seeds	Phased off and invited Pioneer Hi-Breeds ltd. In 1990
3.	Total Agric. Company	Olokoto Oyo State	1987	Production and marketing maize hybrids and O P seeds	Closed down
4.	Greenland Farm Ltd.	Kwara State	1987	Production and marketing maize hybrids and O P seeds	Closed down in 1991
5.	UAC Agro-seeds	Zaria, Kaduna State	1988	Production and marketing maize hybrids and O P seeds	Operational, trying for collaboration with PANNAR South Africa
6.	UTC Seeds	Jos	1988	Mid altitude maize and wheat seeds	Operational
7.	Pioneer Hi-Breeds Seeds Nigeria Ltd.	Zaria & Lagos	1990	Research production and marketing of quality seeds of maize, sorghum and sunflower hybrids and varieties of sorghum, cowpea, soybeans, cotton, rice and whole range of vegetables.	

Nigeria has been struggling to ensure that the seed industry does not crumble completely. An update of the year 2013 seed register shows that there are a total number of 73 licensed seed enterprises in Nigeria. Out of this number four are large scale seed companies; seven are medium while twenty-eight are small scale, twenty-seven are producer/dealer and the remaining six are only licensed seed dealers. Below is a table showing the current list of licensed seed enterprises in Nigeria.

Table 2: 2013 List of Licensed Seed Enterprises in Nigeria

Large Scale Seed Companies					
S/N	**Name of Company**	**Location**	**Name of the CEO**	**E-mail address**	**Phone Number**
1.	Premier Seeds Nig. Ltd.	Chikaji Industrial Estate Zaria, Kaduna State	Dr. Mathew Omidiji	omidijimathew@yahoo.ca	08037033225
2.	Maslaha Seeds Nig. Ltd.	Plot 87, Rijiya Road Gusau Industrial Estate, Gusau, Zamfara State	Alh. Ibrahim Abdullahi	maslahaseed@yahoo.co.uk	08033737123 08066224143
3.	West African Cotton Company Ltd.	Km 15 Sokoto Road, Funtua, Katsina State	Mr. Rahana	wacot@clicktgi.com and pankaj@cliktgi.net	07064016449 08087188666 07034180636 07034180636
4.	Notre Seeds Ltd.	Director, Notore Chemical Industry, Former Nafcon, Onne PMB 5180 Port Harcourt and Notore Industrial Estate, Onne, Rivers State.	Ivana Osagie	Ivana.osagie@notroe.com Fungayi.simbi@notre.com	08054764776 08033805902

Medium Scale Seed Companies					
S/No.	**Name of Company**	**Location**	**Name of the CEO**	**E-mail address**	**Phone Number**
1.	Candel Seeds Ltd.	Kundenda Industrial	Mahmud Hussaini	mhussaini@andelcorp.com andarubu@candelcorp.com	08039162735 08082268951
2.	Alheri Seeds Nig. Ltd.	No. 5 Sokoto Road GRA Zaria, Kaduna State.	Engr. Yakubu Attah	yakubuatar@yahoo.com	08028433820 08063416241
3.	Terratoha Seeds Ltd.	105, Maganda Road, Kano, Kano State	Alh. Hans	operations@terratiga.com	08035716863
4.	Value Seed Ltd. Kano	No. 28/30 Niger Street, Kano, Kano State	Mr. Jodge Zingina and Cassandra George	valueseeds@yahoo.com	08033175351 08089828831
5.	Ni'ima Integrated Services Ltd.	No. 25 Yero Avenue, Chikaji Ind. Estate, Zaria	Alh. Nuhu Aliyu	Nuhualiyu35@yahoo.com	08057124480 08060282125
6.	Kojoli Farms Ltd.	Km. 2 Kojiliso's Road, Kojoli, Kojoli, Adamawa	Alh. Hamman Bello Ahmad	ahmed-bb@yahoo.com	07034091015 08052645849 07083852685
7.	Green Agriculture West Africa Ltd.	Warra Irrigation Scheme, Ngaski LGA, Kebbi	Mr. Wang Miao	agriculture @cgcoc.com.cn	08082268951 07034179854 08082268957

Small Scale Seed Companies					
S/No	**Name of Company**	**Location**	**Name of the CEO**	**E-mail address**	**Phone Number**
1.	Nagari Seeds Nig. Ltd.	No. 1 Sokoto Road, GRA, Zaria, Kaduna State	Mr. Abba Boman	nagariseedltd@yahoo.com	08028431210
2.	Savannah Seeds Ltd.	No. 7 Julius Bala Crescent, Old Legislative Quarte4rs, Jos, Plateau State.	Mr. Olafare Richard	savannahseedsandlivedstock@yahoo.co.uk	08033139794
3.	Asma'u Memorial Farm Ltd.	No. 10 Aminu Galadima Way, Jimeta-Yola.	Alh. Tukur Muazu	asmauseedsltd@gmail.com	08025253600 08035762100 08037780803 08055064829
4.	Champion Seeds	Jos Road, Zaria., P. O. Box 587, Zaria, Kaduan State	Mr. Samuel Nwokrie		07037107881 08028452420 08025861024
5.	Girmal Agric. Company Services Ltd.	Yola.	Mr. Maliki Daniel	Malikidaniel2010@yahoo.com	08037703520
6.	Dans Agro Industrial Company Ltd.	NIB Building, No. 18 Waff Road, Kaduna, Kaduna State.			

7.	Wadata Seeds	No. 32 Kanawa Street, Sabon Gari, Zaria, Kaduna State.	Daniel Gaiya	wadataseeds@gmail.com	08057274193 08169051241
8.	Manoma Seed	No. 19 Dutse Reme, Katsina Road, Funtua, Katsina State.	Mr. Moses Abba Boman	manomaagric@yahoo.com	08039652443 08065028575
9.	Green Saands Technical Ltd.	Damaturu	No. 19 Dutse Reme, Katsina Road, Funtua, Katsina State		08033905160
10.	M'Billa Farm	Mayo Belwa, Jada Road, Mayo Belwa, Adamawa State.	Murtala Nyako		
11.	Da-All Green-Zaria	No. MTD Road, Off GRA, Zaria, Kaduna State.	Engr. Yakubu Attar	yakubuatar@yahoo.com	08028433820 08037016371 08063418241
12.	Seed Project Company Ltd. Kano	No. 44/77 Gidan Buhari Shopping Complex, Kano, Kano State.	Alh. Lawan Gwadabe	seedprojectcoy@yahoo.com	
13.	Maina Seed Kano	No. 13 Kano Road, Ugongo LGA, Kano State.	Alh. Auwalu Balarabe	mina-seeds@yahoo.com	08036150959
14.	Elite Seed Company Ltd. Panda	Farm 20 Panda Commercial Farm, Panda, Nasarawa State.		keithyoung@yahoo.co.uk	08030726483

15.	Daddo Seed/Seedlings Ltd. Yola	K m 11 Noma Road, Jemeta, Yola.	Alh. Tukur	daddoseed@daddogrouop.com	08037003868
16.	Techni Seeds Ltd.	19 Buhari Shopping Complex, Haddeja Road, Kano.	Stella Thomas	techniseds@yahoo.com	08023809270
17.	Ideal Agro Ventures Nig. Ltd. Bida.	Opp. Federal Poly., Bida, Nigeri State.	Dr. Maji	agroideal@gmail.com tswakoma@gmail.com	08030727786 08036332245 07060929070
18.	Gold Agric. Nig. Ltd.	No. 4 Sokoto Road. Opp. NEPA Bulk Station, Hanwa Zaria, Kaduna State.	Prof. John Oyibe	jeonyibe@yahoo.com goldagric04@yahoo.com	08037020997
19.	Springfield Agro Ltd.	Chikanji Industrial Estate, Zaria.	Pradeep Kumar Sarkar	pradeep@springfieldagro.com	803975351
20.	Badala Azare (B) Farmers Co-operative Society	C3C5 Adamu Jumba Rd. Bauchi.	Att'ib mamood	muhabnigerialimited@yahoo.com	08036019864
21.	Evergreen International Ltd.	No. 2 Oyo Street Garki, Area 2, Abuja.	Amb. Joseph Jayeola Lewu	Lewu200@yahoo.co.uk	08036926999 08037462520
22.	Iyadalim Global Ventures	Plot No. 3 Mando Road, Kaduna.	Ah. Liman	iyaladamu@yahoo.com primenet.primenet@gmail.com	
23.	Godilogo Farms Nig. Ltd.	Plot 808 Life Camp, Abuja.	Alh. Jimoh Rasheed	info@godilogiofarm.com	8073831011

24.	Share Foundation	14 Lasun Adigun Street, Off Ring Road, Ibadan.	Fagade Samson Olaseni	samfag@yahoo.com	8034045872
25.	Nagodo Seeds Nig. Ltd.	65Km off Maraba Jos Road, Dokan Itu, Soga LG, Kaduna State.	Alh. Ahmed Hassan	samobikorie@yahoo.com	08028452420 08091009532
26	Popular Farms and Mills Ltd.	54 Chalawa Industrial Estate, Kano.		Balamorogum.p@stallion Group.com	07033266291 07034160975
27.	Bumfash Nig. Ltd.	610 Street T Phases One, Lowcost, Gwagwalada.	Olorontuba Babatope	bumfashcosult@yahoo.com	8036843816
28.	Melt Down.	No. 4 Gidan Maitangaran,Zoo Road, Kano.	Alh. Sarki Abubakar	meltdownlimited@yahoo.com	08036302515 08125992533

Seed Dealer/Producer Seller					
S/N	**Name of Company**	**Location**	**Name of the CEO**	**E-mail address**	**Phone Number**
1.	Salami Farms Nig. Ltd.	Kaduna	Mr. Salami Alada		08023798364
2.	Institute for Agricultural Research and Training	Ibadan	Mr. Adetumbi I.		07065283864 08050928174

3.	Samek Ventures	Plot 6 Oba Alawode Layout Bode Igbo Ibadan, Oyo State	Dr. S. A. Alakojo	saolakajo@yahoo.co.uk	8034671714
4.	Ogun State Agro Service Corporation	Asero Abeokuta			
5.	Delta Agric. Procurement Agency	Delta ADP Ibusa	Mr. Ishaika		
6.	Tony Best Agric. Centre	Benin			
7.	Nyam Agric. Ventures Kaduna	Km 30 Off Prison Farms Kujama, Kaduna State.	Mr. Musa Nyam		
8,	Inganchi Seed Limited Katsina	Plot A5/24 Kofar Kaura Layout Katsina, Katsina State.			08072515667 07027078064
9.	Matthtech Agro Nig. Ltd.	3C Aliyu Makama Rd. Barnawa, Kaduna, Kaduna State			
10.	Royal Seed Agriculture Nig. Ltd. Ibadan	6, Egun Jenmi Street Ibadan, Oyo State.		yemisirohyalseed@yahoo.com	08023376520 07029482503
11	Jirkur Seed Producers Cooperative Society Maiduguri	Nasarawa Ward, After Community Bank, Gombe Rd, Biu, Borno State.	Mrs. Mohammed Biyu		08063626110 08086235321 08063626110

12	Romarey Ventures Nig. Ltd. Kuje and Jos	No. 2 Giindiri Junction Rd. Mangu, Plateau State.	Mr. N. Y. Longmut		07037132794 08058709592
13	Agritropic Limited Nigeria – Kaduna	No. 129 M, Mohammed Rd., Gasham Building, Kano.			
14	Manuwa & Ninah Nig. Company Ltd.	No.30 Idi Quarters Gombe		manuwaninahseed@gmail.com	8065948724
15	MHN Enterprises	Grorue-Mayo Belwa Rd., Adamawa State.	Alh. Musa H. Nyako		07083852686 08052645849
16	First Let Farm	37 Hosptial Rd., 24 Oluwatoyin Quarters, Akure	Alex Olusola		08034968675
17	Perfect Impact Ltd.	15, Siyanbola Str., Off Bishop Str., Igbona, Oshogbo 1	Joseph Oladipo Olu-Olniyi	perfectinpact@yahoo.com	08033700793 08053653666
18	Goke Alade Farms Ltd.	Irawo via Saki, P.O.Box 6945, Agodi Post Office, Ibadan.	Adedeji Joseph Adegoke		08055462335 08032221894
19	Emroyal Ventures Ltd.	No. 1 Afilaka Avenue, Ifako, Agege	HRH Emmanuel Oyebanji		
20	Eunimax Farms Nig. Ltd.		Nwude Emmanuel C.		

21	Adi Farms	Km 34 Abuja-Keffi Rd.	Chief Dangabr E.	Dangabarmela@yahoo.com	
22	Lumiere Seeds Ltd.	Behind Welfare Quarters, Beside Fevoson Pry. Sch. Kanshio, Makurdi, Benue State	Dr. C. U. Egbo	drcuegbo@yahoo.com	08064688138 08087088826
23	Angyushishi Nig. Ltd. (Former Tsazadi)	Adjacent Delly Petrol Station, Jalingo	Elder Bala Aji	kinkisouventure@yahoo.com	0803435620
24	Dalas Links Resources Ltd.	No. 10 Malaraba Takum Rd., Donga LGA Taraba State.	Mr. Dauda Lazarus		0803656610 08024777182
25	Boman Farms Nig. Ltd.	Km Jalingo-Wukari Rd. Jalingo	Alh. Baba Mamman Boshe		08036315505 07058100757
26	Jomas Agro Farms	E. 3 Irra Rd. Tudun Nupawa, Kaduna	Joseph Olusegun Aina		08069555317 08028411472
27	Gatco Chempharm Ltd.	NRC Plot 34 Bodija Level Crossing, Ibadan.	Akintibu Ekundayo		803375691

Seed Dealer/Seed Marketer					
S/No	**Name of Company**	**Location**	**Name of the CEO**	**E-mail address**	**Phone Number**
1.	Bicco Agro-Product Ltd.	1, Alherlink Off Zaria Rd, Jos.	Mr. Nnamdi S. Ukoko	biccoagro@gmail.com	07090052080
2.	Mercy Agro-Allied Nig. Ltd.	2, Sokoto Rd. VIO Zaria	Dr. Agunbiade	mercyagroallied@yahoo.com	08036990998
3.	Ella Agro Company	1, Ibadan Rd. Sabon Gari, Kano	Okafor Okwudile C.	ilechi@yahoo.com ellagro@yahoo.com	08032875237 98185117734
4.	Isah Agro Seeds and Chemicals Company	No. 13 Sadauki Street Wusasa, Zaria, Kaduna	Alh. Isah Gambo	wailare@yahoo.com	08039606838
5.	Swiss Biostadt Ltd.	387 Agege Motor Rd., Cappa, Lagos State.	Prince Emmanuel Ajayi		08017746708 0807358796 0807936375
6.	Sahib Nigeria Ltd.	No. 7/8 IBB Rd. Kano.	Alh. Kabiru Alhasan	yahyakabiru@yhoo.com	80531338863

SELF-ASSESSMENT EXERCISE

By your assessment, would you describe the Nigeria Seed Industry as being vibrant? What are your suggestions for improvement?

4.0 CONCLUSION

The Federal Government of Nigeria pioneered the quest for a vibrant seed industry in Nigeria. With the assistance of International agencies like F.A.O, UNDP, and the World Bank, much was achieved. Awareness was created and private seed companies started springing up. Most of the local varieties of some major crops produced in Nigeria are now almost extinguished because people have discontinued their use in preference to improved varieties. In spite of these achievements, much still needs to be done by you and me to sustain and improve on what has already been achieved.

5.0 SUMMARY

1. Federal Government realising the need for an efficient seed system approached FAO in 1974 which gave birth to National Seed Service in 1975.
2. Seed processing and testing facilities were first installed at Ibadan and Samaru Zaria between 1975 – 1980.
3. First private owned Nigerian Seed Company – Agricultural Seeds Limited, Zaria, Kaduna State. This was established in 1985.
4. Between 1985 – 1994, seven seed companies were established. However, with time some of them were closed.
5. Nigeria has been struggling to ensure that the seed industry does not crumble completely. An update of the year 2013 seed register shows that there are a total of 73 licensed seed enterprises in Nigeria.

6.0 TUTOR-MARKED ASSIGNMENT

1. Which foreign bodies assisted Nigeria in the establishment of a seed industry and did the assistance yield any meaningful development?
2. How many seed companies do we have now in Nigeria? Name at least five of them.

7.0 REFERENCE/FURTHER READING

Adedipe**,** N. O. et al. (1994). Evolving the Nigerian Seed Development Plan. Federal Department of Agriculture, Abuja, Nigeria.

MODULE 2 SEED PROGRAMME DEVELOPMENT

UNIT 1 FORMULATION OF A SEED PROGRAMME

CONTENTS

1.0 INTRODUCTION

Before the advent of scientific knowledge, farmers believed that plants transfer good characters to their offspring. Based on this belief, the more robust and good appearing seeds were usually selected from a farmer's harvest and reserved as seed for next seasons planting. This action in most cases did not produce the expected results. Plant breeders are now working on crop improvement. Genes responsible for certain desirable characters in crops are now being transferred through breeding techniques to develop new crop varieties.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain what is meant by a seed programme
- explain the types of seed programmes that can be formulated
- discuss the steps involved in the development of a seed programme.

3.0 MAIN CONTENT

3.1 What is a Seed Programme?

A seed programme is essentially a scheme of activities planned and implemented to secure timely supply of improved seeds of the desired quality and required quantities. The effectiveness of seed programme are however, better appreciated when other factors of production like inputs (fertilizers, herbicides, pesticides) are adequately supplied.

3.2 Types of Seed Programmes

The major objective of developing a seed programme is to improve agriculture through the supply of improved good quality seed. There are three types of seed programmes.

3.2.1 Official Seed Programmes

In an official seed programme, the government bears the complete responsibility of developing the programme and making good quality seed available to farmers.

The disadvantages of official seed programme are:
(a) There is seldom any concern for return on investment, or even for recovery of capital costs.
(b) Such programmes are often subject to pressures and usually too frequent personnel changes which mar its progress.
(c) Such programmes are not very efficient.

In view of the above disadvantages, there is need for private seed programme in order to ensure the survival of seed industry.

3.2.2 Semi-official Seed Programme

A semi-official seed programme involves the establishment of a national agency to produce, process and distribute seed. This is a more remote form of Government participation. Such an agency may be established at the initiation of a programme or at a subsequent phase of less direct government participation. Such agencies operate as autonomous units and are usually more commercial in nature. Better managed than government own and more efficient in operation.

3.2.3 Private Seed Programme

Private seed enterprises are agencies that handle production and distribution of seed as a business. These are enterprises that are well managed and capable to stand competition. This kind of seed programme is common in most developed economies like the United States and Western Europe. No Government involvement.

In developing countries, the best approach is to involve the three types of seed programmes (the government, semi-government and private agencies) to ensure adequate seed delivery system.

3.3 Steps Involved in Development of a Seed Programme

Once a decision has been taken to commence a seed programme, the next step is to plan its organisation and operation chart, (Organogram chart). This is a highly technical assignment and is also time consuming. It involves the collection and analysis of pertinent data on the various requirements. It is strongly advised that targets should be precise and carefully avoid over production while preparing the blueprint. Seeds by its natue are perishable and excess production may lead to wastages. The development of a viable seed programme should therefore conform to the following steps:

Collection of Pertinent Data

The first step in the development of a seed programme is to collect data:

1. On the population of farmers, the programme is expected to serve and the number of hectorage to be planted.
2. **Availability of superior varieties**: It is important to know the list of available superior varieties, their areas of adaptation and expected yield. Information on farmer's preferences should also be noted. Such information is valuable so that seed programme will develop the particular variety or varieties of seed in demand.
3. **Availability of other inputs:** Availability of irrigation with other inputs, (fertilizer, insecticides) will encourage farmers to plant more hectares and eventually there will be higher demands in seeds.
4. Seed rate for individual crop which will help in knowing the total number of kilogrammes needed per year.
5. Seed producer should be well grounded to know when new varieties should be introduced. (Renewal period).
6. Role played by extensions agents in getting farmers aware of the existence of high yielding varieties.
7. Collection of climatological data: detailed climatological data is necessary for the preparation of a calendar of operations for seed production and processing (seed drying, processing, storage and distribution of seeds).

8. Package of agronomical practices is needed to guide farmers to produce good crops.
9. Financial resources of seed growers.

3.4 Basic Strategy of Seed Production

The following strategies should be adopted to ease seed production and marketing of high quality produce.

1. Integrated development: The production of quality seeds is facilitated when all necessary inputs along with social facilities for the well-being of the producers are made available in the production area.
2. Accessibility: The farm should be accessible to aid in transportation of goods

Advantages of Accessibility

(a) It makes it easier and more convenient to provide technical guidance, supervision and training to seed producers.
(b) The integrated development discussed earlier can be executed easily.
(c) It facilitates Seed Certification Officers in discharging their duties.
(d) Substantially lowers the overhead expenses.

3. Organisation of production: Seed production is usually organised in one of the following ways:

(a) Through selected contract growers
(b) By direct effort
    1. In a contract system of seed production, profit to the seed producers is low.
    2. Quality of seed produced is poor.
    3. Also maintenance of the seed farms is poor

In a direct effort system:

1. The production of seed is undertaken by the company herself
2. The company pays for the labor of production
3. Produce good quality seed
4. Maintenance of seed farm is good

Regardless of the system used, the selected contract growers or production personnel in the direct effort system should have technical ability and personal reliability.

4. Criteria for site selection: The following criteria must be observed in selection of site for seed production.
    (a) Cropping history of the site to be used should be known so as to avoid contamination by volunteer plants and off-types from previous crops of the same family.
    (b) The area selected should be suitable for production of high quality seed.

(c) For dry season farming, areas with assured irrigation facilities should be preferred.

5. Technical guidance: Active involvement of the agricultural universities/research institutes with seed programmes should be preferred because they are important:
   (a) In developing new varieties and also in screening varieties before release
   (b) In seed multiplication of breeders and foundation seed
   (c) In providing technical guidance
   (d) They can be involved in seed certification and seed testing.
6. Choice of varieties: Only superior varieties of crops adapted to specific agricultural areas should be planted.

SELF-ASSESSTMENT EXERCISE

What are the principles involved in establishment of a seed production venture that is comprehensive in scope?

4.0 CONCLUSION

In conclusion, I wish to reiterate that collection of pertinent data is the first step in development of a seed programme in an area.

- the crop of choice of the people in the area
- climatic factors
- availability of inputs and
- accessibility to aid movement at all times.

5.0 SUMMARY

Development of a seed programme that would ensure timely and adequate supply of high quality seeds is one of the most important sectors of agricultural endeavour. Government and private organisations are expected to partner in the establishment of seed enterprises so as to serve farmers. In an attempt to establish a seed programme, a survey on the people, crop choice, and climatic condition should be carried out.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define what a seed programme is and explain the three different types of seed programmes.
2. List and explain at least six factors on which data must be collected and analyse as a first step in the development of a seed programme.

7.0 REFERENCE/FURTHER READING

Agrawal, R. L. (2005). Seed Technology (2nd ed.). New Delhi: Oxford & IBH Publishing Co. PVT Ltd.

UNIT 2 NATIONAL SEED PROGRAMME FORMULATION PRINCIPLES

CONTENTS

1.0 INTRODUCTION

In developed countries, an efficient specialised seed industry to cater for the enormous seed needs of their farmers has been developed. In some developing countries however, technical know-how and infrastructure for multiplication and distribution of improved seed is yet to be in place. In Nigeria for example, Government gave very high priority to the seed programme in her agricultural strategy, and with UNDP/FAO assistance, has established requisite infrastructure in the public sector. Its objective is to ensure a regular flow of high quality seed of recommended varieties to all farmers at all times. But has the Nigerian government actually achieved her dream on the investment made into the seed industry? Did Nigeria carefully observe the seed programme formulation principles in her bid to establish a seed programme for the country?

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- discuss the underlying principles guiding the formulation of a seed programme for a nation
- explain what is operational in Nigeria and find out if the principles were actually followed.

3.0 MAIN CONTENT

There is a strong economic basis for each developing country to develop a national seed programme. It is only when a seed programme is formulated that a country can fully appreciate her agricultural potentials. Countries differ in the type and structure of seed programmes due to differences in type and structure of governments, handling of agricultural inputs, different climatic and soil conditions, transportation systems, availability of electricity, business structure within the country (level of

free enterprise), goals and priorities of the government, cultural habits of the people, resource base availability, and current methods of seed handling. However, regardless of peculiar structures of any country, adherence to general principles would go a long way to determining either the success or failure of such programmes. A national seed programme must therefore clearly outline the following:

1. Importance and relevance of the seed plan and its integration with national programmes on agricultural development: the importance of seed programme must be clearly spelt out. Farmers should know about the need and the importance of the improved seed since they are the major beneficiaries of the programme. There should be integration with national programmes on agricultural development because farmers are always reluctant to purchase and plant on popular varieties. The programme should therefore provide an incentive that would make farmers try new varieties before they are disseminated.
2. There should be short, medium and long term objectives of the seed plan relevant to the phased development in agriculture: it is highly unlikely that a new seed programme will be self-sustaining. If the seed programme is left solely in the hands of private sector, survivors may be difficult since there are no sufficient returns to make it economically visible, the end result will be failure. The same results will occur if the programme is expected to be self-sufficient in the public sector. Therefore, Government should make it a matter of policy to subsidise seed programmes at least at certain stages of its development.
3. There should be clear policy on seed industry development to meet local and export needs.
4. Seed production targets
5. Roles and responsibilities of public and private institutions in the total programme should be well spelt out.
6. Policy on seed trade development, seed pricing, seed export and seed import is needed. Government policies on the pricing of output will possibly be the ultimate determiner of the success of the programme. If all attention is given to increase production, and increased production does infact become a reality, and no consideration is given to the pricing policies of product or the movement of products from surplus areas to deficit areas, then the farmer will no longer be willing to produce. If no provision is made for marketing of increased production beyond what can be absorbed in the local market, there would be no economic incentive for a farmer to continue to produce.
7. There should be commitment in the national budget for credit facilities without which the programme may fail.
8. There must be means of guiding, coordinating and monitoring the programme.

SELF-ASSESSTMENT EXERCISE

Outline the fundamental principles involved in national seed programme formulation.

4.0 CONCLUSION

A well-conceived and efficiently managed seed plan therefore is a vital need for every country. For this purpose, the primary requirement is to formulate a National Seed policy. Such a policy has to have an insight into the future and should also consider the current situation of the programme.

5.0 SUMMARY

We have outlined up to ten fundamental principles to be followed to have a successful national seed programme. There is need to sensitise farmers about the benefits of the seed programme and the various areas the central administration would need to render assistance before the programme is eventually put on a sound footing. These principles must never be forgotten but handled with wisdom in any attempt to formulate a seed programme for country.

6.0 TUTOR-MARKED ASSIGNMENT

Outline the fundamental principles involved in national seed programme formulation.

7.0 REFERENCE/FURTHER READING

Agrawal, R. L. (2005). Seed Technology (2nd ed.). New Delhi: Oxford & IBH Publishing Co. PVT Ltd.

UNIT 3 VARIETY DEVELOPMENT AND RELEASE

CONTENTS

1.0 INTRODUCTION

There are laid down procedures that guide the orderly and successful operations of every human endeavour. It is therefore important for anybody interested in any discipline, to study not only the technicalities involved in the successful operation of the discipline but also details about the rules guiding its operations. Seed men should be well informed about the procedures for release of new varieties.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain the correct procedure for variety development and release as established in decree 33 of 1987
- state the problems that were encountered before the enactment of the decree
- list the procedure for naming new crop varieties.

3.0 MAIN CONTENT

3.1 Variety Development and Release

The development of new varieties is achieved by plant breeders (IITA, LCRI, CRIN, RRIN etc.) who work in collaboration with agronomists, plant pathologists and other experts. Their main task is to transfer good characters which are in genes from wild, foreign or even other crop species to species of their choice. Once a new variety of crop is developed,

a procedure was in decree 33 of 1987 for registration, naming and release as new crop variety.

3.2 Problems Created by the Absence of a National Mechanism for Crop Variety Certification, Registration and Release

1. Breeders in Research Institutes and elsewhere regularly made claims to the development of new crop varieties.
2. Some breeders believed that varieties developed by them in the past were being repeated by others. It encourages fraud. Variety developed by one institute can also be claimed by another institute.
3. There was no control of the release of the new varieties
4. There was no control of introduction of crop varieties from outside the country and their release for use.
5. The issue of breeders' rights and patenting of new crop varieties had to be handled by a competent national body as the private sector went into intensive agriculture.
6. There was no documented list of varieties that have been developed by breeders in various research institutions and universities in the past.
7. The system of naming crop varieties was not unified.

3.3 Approved Procedure for Registration, Naming and Release of New Crop Varieties

Due to the problems encountered with the new varieties, decree 33 of 1987 was promulgated which provided for the appointment of the National Committee on Registration and Release of crop varieties and Livestock Breeds. This Committee was inaugurated on 1st March, 1988 and the Committee appointed two Technical sub-committees, one for Crops and the other one for Livestock. With the recommendation of the Technical Sub-committee on Crops, the National Committee has now approved the following procedure:

1. Nomination of a new variety should be made by an Institute or Organisation.
2. Such nomination made to the relevant Nationally Co-ordinated Research Project (NCRP) must be accompanied with the relevant production package.
3. The variety after nomination should undergo multilocational trials by the NCRP for at least two years, after which if found outstanding is passed on to the National Accelerated Food Production Project (NAFPP) which in collaboration with the Agricultural Development Projects (ADP's) subjects the nominated variety to on-farm testing. For exceptionally outstanding varieties, however, this will be done at the end of the first year of NCRP multilocational testing.

4. At the end of 2 (for exceptionally outstanding varieties) or 3 years for other promising candidates, the result from both the NCRP and the NAFPP would be submitted to the Technical sub-committee which will appraise the data and make recommendations to the National Committee.
5. During the first year of testing, after nomination, the breeder should undertake seed increase of the variety for possible on-farm trials.
6. Crop varieties that are imported by individuals/organisations for restrictive use should pass through the relevant NCRP for registration. Where the varieties will be distributed to local farmers for wide spread use, such varieties must undergo the NCRP multinational trials.

3.4 Nomenclature

The National Committee stipulates that the naming system should comprise:

1. A general code (NG) and
2. A variety name.

The national code should reflect the country name i.e. NG for Nigeria, crop botanical name, year and serial number (according to the number of varieties released for a specific crop). For example, the code name for maize (*Zea mays*) will be NGZM-07-1, the next variety of maize NGZM-07-2, etc. The first letter of the genetic and specific names will be used to represent the crops in the national code.

The variety name will be suggested by the breeding organization/breeder(s) according to the following guidelines:

- Consistency in nomenclature
- The name should reflect the major character of the variety in any Nigerian Language including English.

SELF-ASSESSTMENT EXERCISE

Discuss the problems that necessitated the promulgation of decree 33 of 1987?

4.0 CONCLUSION

We have discussed the various problems breeders face with the absence of a national body for co-ordination of agricultural research. These problems included false claims by some acclaimed breeders and how difficult it was to authenticate them. We have also seen how decree 33 of 1987 was promulgated in an effort to curb some of these problems and

the procedure it provided for registration, naming and release of new crop varieties.

5.0 SUMMARY

In this unit we have learnt that it is wrong for any individual to just wake up with a claim of initiating a new variety without following the laid down procedures enumerated in this unit. We are therefore properly educated on the accepted procedure in order that we are not deceived.

6.0 TUTOR-MARKED ASSIGNMENT

1. Clearly outline the approved procedure for registration and release of new crop varieties?
2. With a given example, describe the approving naming system for new varieties?

7.0 REFERENCE/FURTHER READING

Adedipe**,** N. O. et al. (1994). Evolving the Nigerian Seed Development Plan. Federal Department of Agriculture, Abuja, Nigeria.

MODULE 3 PRINCIPLES AND METHODS OF SEED PRODUCTION

UNIT 1 WHAT IS SEED? DISTINCTION BETWEEN SEED AND GRAIN

CONTENTS

1.0 INTRODUCTION

Many people still find it difficult to distinguish between seed and grains. They therefore make the mistake of selecting grain from their harvest meant for food, feed or industrial uses to be used as seed for the next planting season.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain what agriculturalists, refer to as seed
- describe and differentiate between a seed and a grain.

3.0 MAIN CONTENT

3.1 What is a Seed?

A seed is a living biological entity comprising of a seed coat (which is the protective cover), an endosperm or in some cases cotyledon (which serves as food reserve) and an embryo (which is the seat of life), and which when exposed to favourable conditions (i.e. moisture, oxygen and temperature) would develop into a seedling. From this definition, it can be seen that the embryo is embedded in a supporting food storage organ all of which enjoy the protection of a protective cover. The embryo is also the organ in a seed component that initiates development and produces a seedling under favourable conditions. The embryo is therefore the seed. Seed technology therefore seeks to protect this biological entity called embryo and look after its welfare, while the focus of food technology is on the second component i.e. the supporting tissue and in some cases the protective cover. A seed is therefore produced to be used as planting material while grains produced to be used for food, feed or for industrial uses.

3.2 Differences between Scientifically Produced Seed and Grain (used as seed)

1. Seed is the result of a well-planned seed programme for planting, whereas grain is planted for commercial purposes (eating, animal feed and industrial uses).
2. Seed is the result of sound scientific knowledge, organised effort, investment on processing, storage and marketing facilities, whereas no such effort or knowledge is required in grain production.
3. The pedigree of the seed is ensured as being related to the initial breeder seed, whereas the varietal purity of grains is not known.
4. Efforts are usually made during seed production to rogue out off-types, diseased plants, objectionable weeds and other crop plants at appropriate stages of crop development to ensure satisfactory seed purity and health. However, no such effort is made in grain production; hence the purity and health may be inferior.
5. Seed is scientifically processed, treated, packed and labeled with proper lot identity, the grain used as seed may be manually cleaned, in some cases prior to sowing. It may also be treated but not usually labeled.
6. Seed is tested for planting quality, i.e. germination, purity, admixture or weed and other crop seeds, seed health and seed moisture content. These are not done with grains.
7. Whereas the seed quality is usually supervised by an agency not related with production (seed certification agency), there is no quality control with grains.

8. Quality standards have already been set which seeds have to meet before they are accepted as seeds, the quality of seeds is therefore well known. No such standards apply with grains. The quality is not known.
9. The seed containers carry certification tags which serve as quality marks, while grains do not have labels certification marks.

SELF-ASSESSTMENT EXERCISE

What is a seed? Explain using the seed component, how seed technology differs from food technology.

4.0 CONCLUSION

It is important to conclude that seeds are living beings like you and I. scientifically produced seed on the other hand are bred to meet up with certain desirable characters. Seed production therefore requires more effort and attention than ordinary grain production.

5.0 SUMMARY

As a living organism, every seed has three basic units i.e. protection, food and life and can develop into a seedling under favourable conditions. Seeds differ from grains in terms of management and purpose for which they were produced. While seeds are produced to exhibit certain desirable characters, grains are produced for food, feed and industrial uses.

6.0 TUTOR-MARKED ASSIGNMENT

Compare and contrast the major differences between seed and grain.

7.0 REFERENCES/FURTHER READING

Agrawal, R. L. (2005). Seed Technology (2nd ed.). New Delhi: Oxford & IBH Publishing Co. PVT Ltd.

Subir, S. & Nabinananda, G. (2010). *Seed Science and Technology.* New Delhi, India: Kalyani Publishers.

UNIT 2 SEED GERMINATION, VIGOR AND DORMANCY

CONTENTS

1.0 INTRODUCTION

Germination, vigour and dormancy are the three words that usually determine the beginning of a farmer's happiness or woes in each cropping season. When seeds have been sown, it is expected that after a given duration for that kind of seed, it should germinate. Failure of seed to germinate after that duration gives the farmer a lot of worries. Farmers will be wondering if the seed is not viable or dormant. However, when there is a very high percentage of uniform germination and growth, the farmer's happiness and expectation of a bumper harvest begins. It is therefore important that seed men should study these three concepts and know what enhances or hinders seed performance.

2.0 OBJECTIVES

By the end of this unit, you should be able to:

- define germination, vigour and dormancy
- explain the factors affecting germination and vigour
- state the classes of dormancy
- describe the special treatments for breaking of dormancy.

3.0 MAIN CONTENT

3.1 What is Germination?

Germination may be defined as a sequence of steps beginning with the absorption of moisture by the seed which ultimately lead to rapture of the seed coat, emergence of radical and plumule from the embryo. A seed retains the total biological potentials of the parent plant and maintains the living conditions of the cells of seed tissue at the lowest moisture levels. With the intake of water, all cells of the seed turn turgid and physiology activities resume. Active metabolism, triggers cell growth and differentiation in the embryo i.e. cell multiplication – cell growth – polarized development of the embryo into plumule and radical which ultimately produce the seedling through further differentiation and development.

3.1.1 Factors Affecting Germination

Although there are several factors that influence germination, the major factors that are necessary for germination are:

1. **Moisture:** Rehydration of dry seeds is essential for germination. The extent of water inhibition depends on the chemical composition of the seed, permeability of the seed coat and availability of water in the environment. Inhibition is not related to seed viability. Even dead seeds can imbibe water. Absorption of water initiates and accelerates the physiological activities in cells of seeds. The initial intake may not exceed 2 – 3 times the dry weight of seed, in general. It causes swelling and softening of the seed, helping the developing embryo to burst through the seed coat.
2. **Oxygen:** it is needed for respiration and all the physiological activities, which proceeds at an accelerated rate at this stage. Water acts as a vehicle to carry additional oxygen in seed. Availability of oxygen is the most important factor for initiating and mobilisation of the processed food during germination.
3. **Temperature:** different seeds germinate at different temperature regimes. Very low or very high temperatures prevent or retard germination of seeds. Generally, germination is most satisfactory around 25 ± 3^{o}C. The temperature range over which germination occurs has been considered as maximum, optimum and minimum temperatures. Such values are termed ‘cardinal temperatures’. Optimum temperature helps maximum germination at a high rate. The rate of germination and rate of growth of seedlings increase with a rise in temperature, until at an upper temperature limit for growth when the rate of germination slows down.

3.2 Seed Vigor

Seed vigor can be defined as the sum total of all those properties in seed which upon planting result in rapid and uniform production of seedlings under a wide range of environments including both favourable and stress conditions. Seed vigour refers to the ability of some seeds in a seed lot to overcome or withstand adverse conditions during germination and produce seedlings of uniform growth with the rest seeds. Vigour index can be calculated as (Seedling root length (mm) + seedling shoot length (mm) x germination percentage.

Example:
Let us assume seedling root length after 10 days of planting to be 8mm while the shoot length is 10mm. germination percentage of the entire farm or plot is 98 percent.

$$\text{Vigor index} = 8\text{mm} + 10\text{mm} \times 98\% = \frac{18 \times 98}{100} = 17.64$$ is your vigour index

This vigour index will be compared with other seed lots to determine the best seed lot. The higher the vigour index, the better the lot.

3.2.1 Factors affecting seed vigor

These factors affecting vigor have been grouped according to their origin. It can be internal and external factors.

Internal Factors (inherent factors)

(i) **Genotype**: The competence of a genotype in a particular environment determines seed vigour. Pigmented groundnut seeds (i.e. those groundnut seeds with serrated line) were found to be tolerant to fungal invasion in soil and therefore have better emergence ability over non-pigmented seeds.

(ii) **Seed size**: Bigger seeds of most crops have been found to exhibit superiority in field emergence than small seeds.

(iii) **Harvest maturity**: the appropriate stage of seed harvest controls vigour. For all crops, harvest at immature stage produce seeds with less vigour. Fully matured seeds that have attained physiological maturity produce seeds with high vigour.

External Factors

(i) **Mechanical injury at harvest:** seed injured during harvest loose vigour. Storage or shelve life of some of the legume seeds like *Vigna mungo* causes reduction in vigour.

(ii) **Pre-harvest conditions**: if the climate during seed setting is adverse or the seed producing plants have suffered from nutrient

deficiency, the seeds produced would have low vigour. Healthy seeds produced by healthy plants have more vigour than those suffering from disease and insect pests attack.

(iii) **Soil temperature and moisture:** extreme conditions of soil temperature either cold or hot produce varying effects on different crop seeds. For example, maize seeds have been known to be very sensitive to cold soil conditions. Seeds of *Phaseolus vulgaris* with coloured testa show equal vigour in cool and warm soil, but seeds of non-coloured testa are sensitive to low temperature. In some cases, over ripened seeds also generate vigour.

(iv) **Effect of tillage and fertilizer**: Adequate applications of NPK at recommended levels and proper tillage operations have influence on the seed yield and vigour of plants.

3.3 Seed Dormancy

Seed dormancy is a condition in which viable seeds fail to germinate even when provided with optimal conditions for germination. Dormancy in general sense is the period between seed maturity and seed germination. Therefore, all seeds that can be retained in long-term storage are said to be dormant. Dormancy is a special mechanism to repress all regeneration activities for germination of seeds. Vegetative bulbs, rhizomes, bulbis, etc also have dormancy period. The entire mechanism involves the blocking of epical meristem activity, growth and differentiation of embryo in the seed or the vegetative bud in the propagule. Seed dormancy is however different from seed vibrancy though sometimes mistaken to be same. But in the real sense, seed vibrancy mean how many times or production cycle can a seed from same parent be replanted.

3.3.1 Classification of Dormancy

Seed dormancy can be classified as exogenous and endogenous depending on the causes responsible for expression of this mechanism.

Exogenous dominancy: Some of the causes of exogenous dormancy include:

(i) **Low temperature**: certain seeds like apple seeds remain dormant at ambient temperature after harvest. They require low temperature or chilling treatment to break dormancy.

(ii) Some seeds will not germinate at ambient temperatures; high temperatures also restrict the germination of certain seeds.

(iii) Light: seeds of some crops which are sensitive to photoperiod may not germinate at certain hours of daylight except the required period.

Endogenous dormancy: Causes of endogenous dormancy are:

(i) **After ripening period**: After ripening period which is referred to as dry storage of seed within a specified period of time before processing permits the embryo of many plant families to gradually attain physiological and developmental maturity after harvest.

(ii) **Physical dormancy**: some crops develop excessively hard seed coat due to certain environmental conditions that may prevail during ripening. Hard seed coat usually causes dormancy due to impermeability to water, gases or due to mechanical obstruction to growth and germination of embryo.

(iii) **Physiological dormancy**: the pH and osmotic pressure in the immediate environment of seed may act as inhibitors for germination, while the substances, which inhibit terminal oxidizes, may also control the inhibition or stimulation of germination.

3.3.2 Induction of Dormancy

Dormancy can artificially be induced or introduced to seeds that naturally non-dormant. Such induced dormancy is referred to as secondary dormancy. For example, seeds of *Brassica alba* would retain dormancy for a long time if exposed to high concentration of Carbon dioxide.

3.3.3 Breaking of Seed Dormancy

Special treatments have been developed for breaking dormancy. Some of these treatments include:

(i) **Scarification:** Any physical or chemical treatment which weakens or softens the seed coat is known as scarification. It is used when the dormancy is due to hard seed coat as in legumes. Some of the methods normally use are rubbing the seed on a sand paper manually or with the help of mechanical scarifier, or by piercing the hard seed coat a little with needle.

(ii) **Stratification:** This is the use of temperature treatment to break the seed dormancy. Sometimes seeds are subjected to pre-chilling or incubating treatments at low temperatures (0 to 5^{o}C) over a moist substratum for 3 to 10 days.

(iii) Treatment with growth regulators: Treatment at low concentration of growth regulators and other chemicals may break the endogenous dormancy of seeds caused by the presence of some inhibitors.

SELF-ASSESSTMENT EXERCISE

Explain at least three special treatments that can be given to seeds to break their dormancy.

4.0 CONCLUSION

Germination, vigor and dormancy are very important physiological aspects of development in plants that can ma or make a farmer's success. The need to know all details concerning this aspect of study cannot be over emphasised as it would enable you to know what to guard against or undertake to ensure the successful take up of your farm.

5.0 SUMMARY

It is advisable that farmers should secure seeds from dependable sources that would guarantee their viability and vigour. Thereafter, adequate favourable conditions for germination should be ensured during planting and efforts should be made to break dormancy of some seeds if the need arises.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define germination, vigour and dormancy
2. Explain the three conditions necessary for germination
3. List the internal and external factors affecting seed vigour
4. Give the classifications of seed dormancy and list the causes involved in each classification.

7.0 REFERENCE/FURTHER READING

Subir, S. & Nabinananda, G. (2010). *Seed Science and Technology*. New Delhi, India: Kalyani Publishers.

UNIT 3 SEED PRODUCTION PLANNING AND OPERATION

CONTENTS

1.0 INTRODUCTION

A plan is a scheme of arrangement drawn up before hand to accomplish a purpose. The main purpose of a seed programme is adequate and timely supply of improved seeds to farmers. A seed programme is therefore essentially a service to farmers and the purpose is realised only when all farmers are able to obtain and plant seeds of improved out varieties at desired time. The improved varieties must also maintain their desired qualities. A seed programme is therefore planned to multiply seeds of newly developed superior varieties without deterioration and in large quantities for the benefit of farmers. Before this is achieved, there has to be a figurative representation of the projected activities on paper, which must be strictly followed.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- list the steps to take set up of a seed programme
- analyse how all the needs would be handled to achieve the set objective.

3.0 MAIN CONTENT

3.1 Seed Production Planning

Seed production planning should be based on a thorough, realistic, objective review and assessment of existing conditions relating to seed

use. Benefits to be derived from introduction and use of superior varieties should also be weighed in comparison to the investments proposed in the plan. It is natural that in the first year of introduction, a seed plan may not show any gains from investments. However, if the effort is sustained for a long duration, the gains that would be generated in the later years would offset the initial loss experienced at the beginning. Therefore, specific needs and supply goals should be established for a 5 to 10-year period by determining:

1. The number of crops to be included for multiplication and distribution.
2. The hectarage of crop land to be planted
3. How the seed would be distributed to the expected farmers?
4. Seed of each crop to be supplied.
5. The level of annual seed increases for each crop variety.
6. The number and size of competing seed producers.
7. The varieties the farmers prefer most and the package sizes that are most convenient, for farmers to buy at affordable prices.
8. The kind of publicity and sales promotion that is most effective in that area.

3.1.1 Seed Demand Forecast

Once the above mentioned basic needs and supply goals are determined then the seed producer could forecast the seed demand of the farmers he wishes to satisfy. The reason why a seed demand forecast is needed in a seed plan is because the seed producer wants her seed to keep pace with seed demand (both present and future) in terms of quantity, quality, price, place and time. When the supply is higher than demand, a substantial portion of the seed has to be regularly disposed off as grain, or stocked to the point of likely loss of viability. When however, the demand is higher than supply, farmers suffer and they may be exploited. If an accurate forecast is made and production carefully planned, the problem of shortages and gluts would be eliminated and there would be stable prices and profits.

The seed producer also need to be current about research activities, to enable him know when a variety in use is likely to be replaced with a newly released superior variety.

3.1.2 Facilities

The facilities that are required for seed production are grouped into two i.e. the seed farm sites and farm equipments.

1. **Seed farm sites:** There is need to identify suitable farm sites for seed production. Such areas should be suitable for production with

good soil and climatic conditions for the crops to be produced. The area should have low weed and disease incidence. Southern parts of Nigeria with heavy rainfalls and high humidity encourage the development of most insect pests of most cops. Furthermore, there is more problem with drying of harvested seeds in these areas than the northern parts of the country. This explains why the bulk of NASC Foundation Seeds (90%) are produced in the North-West and North-East Zones of the country. The suitable climate conditions in the Northern area also encourage establishment of private seed companies in those areas.

2. **Equipment:** Good farming practices may be a pre-requisite for successful seed production. Specific requirements include: tractor, plough, harrow for land preparation, seed planter preferably equipped with fertilizer application accessories. Harvesting can be done manually if labour is cheap and the hectarage is small; if large is involved, combine harvesters may be used where available. Cleaning of harvest equipment is very important to avoid contamination.

3.1.3 Staffing and Training

The staff strength for every seed producing establishment should be determined by the following factors:

1. The total area to be covered
2. The number of individuals fields
3. The distance from the headquarters.
4. The level of education and experience of seed growers

In every seed production plan there is supposed to be provision for staffing and personnel development. Planning and implementation of every successful seed production programme require skilled and motivated staff. The staff therefore need to receive periodic training to keep them up to date with new production practices developed by researchers in Universities and Research Institutes. The managerial, technical and non-technical staff members must be committed for the programme to be efficient and effective. This commitment is shown by their efforts to improve their capabilities, their diligence in fulfilling their duties. They should be placed in positions suited to their abilities, skills and training. Staff morale will be high when they are appreciated, promoted and trained.

3.1.4 Seed Pricing

The price that a farmer will pay for a seed is therefore determined by his perception of its benefits and his ability to pay. The price established by a seller on the other hand include all direct and indirect costs of

production, profit (if any) and an estimate of what the buyer can afford to pay. The direct costs include those for production, processing, transportation and storage. This direct cost is common in public sector. The indirect costs include staff salaries, maintenance costs, taxes and depreciation.

3.1.5 Impact Assessment of Seed Programme

An impact assessment should be made to determine the success or failure of a seed programme. An assessment can therefore be planned to be conducted at intervals of either three to five years. The following can be used as an index for success or failure.

1. Whether or not there has been an increase in total yield resulting from introduction and distribution of superior crop varieties into the cropping system of the country.
2. Determine if there has been a more efficient utilisation of fertilizer, irrigation water and agro-chemicals.
3. Whether or not there has been more rapid and efficient periodic replacement of varieties with newer and better ones.
4. Whether or not there is a change in farmers' income.

SELF-ASSESSTMENT EXERCISE

List the five major units on which panning must encompass in a seed production programmed and explain fully any two.

4.0 CONCLUSION

I would like to reiterate in conclusion that all the issues planned for in a seed programme should always be taken very serious and not overlooked during implementation. Emphasis is laid here on pricing and marketing plans.

5.0 SUMMARY

Seed production planning is very important for the successful implementation of a seed programme.

Planning defines the need for and scope of the programme, establishes targets, integrates it into the overall strategy for development, while implementation refers to scheduling of identifies resources.

The important points to be considered include knowing the varietal preferences of the farmers, estimating seed demand that is predicated on many factors, provision of needed facilities, staff training, seed pricing and impact assessment.

6.0 TUTOR-MARKED ASSIGNMENT

1a. What is a plan?
b. Why is planning necessary in a seed programme?

7.0 REFERENCE/FURTHER READING

Adedipe, O. N. et al. (1994). Evolving the Nigerian Seed Development Plan. The Federal Department of Agriculture, Abuja.

UNIT 4 SEED MULTIPLICATION STAGES

CONTENTS

1.0 INTRODUCTION

The act of developing a new crop variety is a highly labourious task. However, breeders use breeding techniques to transfer genes responsible for certain desirable characters from different sources to develop new varieties. Examples of desirable characters that breeders have improved on are:

- Increased yield
- Increased nutrient content
- Shorter maturity period
- Greater resistance to pests and diseases
- Increased fruit size
- Improved shelf life
- Seedless fruits
- Resistance to herbicides
- Resistance to draught

After development of new crop variety, it must be tested in many locations, registered and multiplied for distribution to farmers. It is the multiplication stages that will be discussed in this unit.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- discuss the respective seed multiplication stages
- explain what is meant by multiplication factor.

3.0 MAIN CONTENT

3.1 Seed Multiplication Stages

The fundamental problem of multiplication is how to increase a small nuclear seed from a breeder to a sufficient level needed by the farming populace without losing the cultivar purity of such seeds. Plant breeders produce new cultivars in a small quantity. Farmers on the other hand require the new cultivar in large quantity without any risk of deterioration to such seed. Seed is therefore multiplied in stages until the desired quantity is achieved. Each stage is assigned a class of identification as breeder seed, foundation seed and certified seed.

1. **Breeder seed:** These are seeds or vegetative propagating materials directly produced or controlled by the originating plant breeder or research institute. Breeder seed that produces foundation seed is the most expensive out of these classes.
2. **Foundation seed** (also known as elite or basic seed): It is the direct increase from breeder seed. The genetic identity and purity of the variety is carefully maintained in foundation seed. In self-pollinated crops or in crops having a low multiplication ratio, it may be expedient to have two classes of foundation seed instead of one. (i.e. foundation and registered classes of seed). Foundation seed is the source of all certified seed.
3. **Certified seed:** This is the progeny of foundation or registered (or second stage foundation) seed. The last category (that is registered seed) is permissible in self-pollinated and vegetatively propagated crop varieties in two situations.
   (a) When the multiplication rate is so low that adequate seed stocks cannot be built.
   (b) When shortage of foundation seed due to natural factors leaves no alternative but to use registered seed for multiplication.

3.2 Multiplication Factor

The multiplication attained in each generation of growing a crop is what is referred to as multiplication factor (The quantity of seed produced in one planting season). Multiplication factor helps to determine the number of generations the seeds would be multiplied without deterioration in its genetic purity.

3.2.1 Determination of Multiplication Factor

Multiplication factor is determined using the formula:

$$MF = \frac{\text{weight of seed harvested}}{\text{Weight of seed sown}}$$

- Weight of seed harvested refers to cleaned and processed seed because seed are lost during processing.
- Sown seeds are calculated from actual seed that are germinated because not all seeds germinate on the field.

In practice multiplication rate varies from crop seed to crop seed. For example, groundnut has a very low multiplication rate, pigeonpea and cowpea have 10 – 20 multiplication factor. Common cereals like barley, wheat, and rice have 20 – 40 MF, maize has 200 while small vegetable seeds e.g. tomatoes, amaranthus, etc have 1000 – 2000 MF.

There is a general correlation between seed size to multiplication rate and is inversely correlated.

- Multiplication rate is low in big seeded crop
- Small seeded crops have high multiplication rate.
- It has to be borne in mind that the agronomic practice applied to crop multiplication e.g. spacing may affect the multiplication rate of such a crop.

SELF-ASSESSTMENT EXERCISE

25kg of rice seed was used for multiplication and a yield of one tonner was realised after one generation of multiplication. What was the multiplication factor attained in the operation?

4.0 CONCLUSION

It is important to state that, there are more risks of deterioration when the generation of seeds goes beyond certified seeds which under normal circumstances are supposed to be the third generation. Farmers should not therefore be deceived to think that any seed whose genealogy is unknown can perform as well as the three classes described above.

5.0 SUMMARY

Foundation and certified classes of seed are the only recognised seeds that can be distributed to farmers without fear of deterioration in quality. Any generation after certified seed is for consumption. Farmers should therefore cultivate the habit of securing certified seeds from authentic sources annually for production purposes.

6.0 TUTOR-MARKED ASSIGNMENT

1. Explain the three classes of seed?
2. What quantity of maize seed was used in a one generation multiplication which yielded one tonne with the attainment of a multiplication factor of 200?

7.0 REFERENCE/FURTHER READING

Adedipe, O. N. et al. (1994). Evolving the Nigerian Seed Development Plan. The Federal Department of Agriculture, Abuja.

UNIT 5 PROSPECTS AND PROBLEMS OF SEED MULTIPLICATION

CONTENTS

1.0 INTRODUCTION

Every business set up has problems and prospects. People are however encouraged to undertake businesses when they are convinced that there are enough prospects in the business to overcome or offset the problems envisaged. A thorough examination of the merits and demerits involved in every business is usually recommended to forestall the danger of having regrets in future. In our unified efforts to feed the nation and the world at large, scientist have discovered that seed is one of the promising factors. The challenge now is for you to venture into the seed industry to contribute your quota. It is therefore important that the problems and prospects are all opened up to you so that you are not in doubt about what to expect.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- discuss what you stand to gain by opening up a private seed enterprise
- discuss the problems involved with running a seed multiplication enterprise.

3.0 MAIN CONTENT

3.1 Prospects for Private Sector Participation in Seed Industry Development in Nigeria

With a rapidly growing population of about 160 million and a growth rate of over 2% per annum, there is an urgent need to rapidly increase food

production. Although Nigeria currently have about 13 million hectares of arable land under cereals cultivation, production still falls short of demand. One of the most viable options to increase production and productivity is through the use of improved seeds which are the products of biotechnological research. Considering the fact that only 10% to 12%of the total improved seed requirements of Nigerian farmers is currently met, only the active participation of the private sector and the co-operation of the government will embrace the development of the seed industry in Nigeria. It is therefore highly understandable that the prospects of seed business in Nigeria are very high.

As a measure of making it attractive for Nigerian farmers to venture into the seed industry therefore, government has adopted the following measures to cushion the efforts of interested investors in the industry.

1. The public sector organisation in the past was selling seed at a subsidised price which discouraged private sector participation. The question for the future was then whether a seed programme to cover the targeted areas with good quality seeds should be developed on commercial lines or on social welfare consideration? It was seen that the social welfare approach in seed development with direct government involvement would commit the official machinery to an intricate task of vast magnitude which is not desirable. The programme has to be developed on commercial lines so that it generates interest, a spirit of competition, a motive of profit, and creates a congenial environment for private sector participation.
2. The pricing policy for the private sector agency is now aimed at full cost recovery.
3. The public sector has now been mandated to deal only with open-pollinated varieties leaving hybrid seed production which is more remunerative for the private sector.
4. The public sector has been directed to withdraw from the production and marketing of certified seed in favor of private enterprises.
5. Private sector seed agencies now have a representation on the NASC and are also involved in policy making on seed issues.
6. Private sector seed agencies now have access to breeder and foundation seeds of publicly bred varieties to enable establishment of seed enterprise without independent research capability.
7. Government now gives assistance to private seed companies in the importation of genetic material for development of their own varieties and hybrids. Besides these policy changes, government has promised to assist the private sector with technical support on management of seed enterprises, establishment of processing plants and seed storage facilities. With these policy decisions,

many private organisations and individuals are being tempted to venture into the business

3.2 Problem of Seed Multiplication

The seed technologist has a double reputation to protect. Firstly, the breeder is interested in seen that farmers derive benefit from his/her many years of work. He/she would therefore not want to work with any technologist who is unable to multiply his/her produce without maintaining its quality. Secondly, the seed technologists' reputation among the farmers who he is serving stands to be lost if his products are not true to type. There are many sources of risks in seed multiplication.

Some of these difficulties include:

a. Availability of adequate quantity of breeder or foundation seed at the source of seed lot.
b. Selection o right seed production area with healthy field and provision of optimal agricultural practices to raise good and healthy seed crop.
c. Availability of enough space to provide appropriate isolation as recommended for seed crop.
d. Adequate facilities for seed harvesting, cleaning and drying.
e. Provision for short time storage of seeds produced
f. Appropriate channel for marketing of certified seed with economically viable pricing.
g. Updating the seed growers by training on the evolving technical packages for maximisation of seed yield.

SELF-ASSESSTMENT EXERCISE

Explain the difficulties that are likely to be experienced by a private organisation or farmer who wishes to engage in the seed production industry.

4.0 CONCLUSION

It is worthy of note that there is still a very high demand for improved seed in Nigeria. Government on her part has done everything possible to encourage private agencies to venture into the seed industry in order to reduce the current shortage. There is however very little response from the private sector maybe because of lack of awareness about the promising prospects that are hidden therein. This unit is therefore encouraging you to step in and you will not find any regrets.

5.0 SUMMARY

Only 10% to 12% of improved seed demand of Nigeria farmers is currently met. Government has promised every needed support to private organisations as stated above therefore, the prospect for seed business in Nigeria is very bright.

6.0 TUTOR-MARKED ASSIGNMENT

How would you convince a private farmer or business entrepreneur to invest in the Nigeria seed industry?

7.0 REFERENCES/FURTHER READING

Adedipe, O. N. et al. (1994). Evolving the Nigerian Seed Development Plan. The Federal Department of Agriculture, Abuja.

Subir, S. & Nabinananda, G. (2010). *Seed Science and Technology*. New Delhi, India: Kalyani Publishers.

UNIT 6 PRODUCTION OF FOUNDATION AND CERTIFIED SEED

CONTENTS

1.0 INTRODUCTION

Food production, distribution and marketing strategies, continue to top the list of the country's aspirations for the attainment and sustenance of national food security. Now that food production is not expanding rapidly enough to keep up with the ever-increasing population, development of the seed of various crop varieties stand as a catalyst for the rapid expansion of food. Consequently, all efforts are being made to bring about an efficient production and distribution system so as to regain the position agriculture once occupied in the Nigerian economy.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain the importance of improved seeds to farmers
- state the procedure by which foundation and certified seeds are multiplied
- explain the role played by out-growers in multiplication.

3.0 MAIN CONTENT

3.1 Importance of Improved Seed

1. Use of improved seeds is the cheapest way of increasing or improving productivity.
2. Improved seeds enhance the effective and efficient use of other inputs like fertilizer, herbicides, agro-chemicals e.t.c.
3. Improved seeds give the most dramatic and highest means of increasing productivity or yield.
4. It is through seed that most plants perpetuate their existence.

5. Seeds have a high multiplication factor and therefore have high potential in enlarging the quality and quantity of their race and of spreading from one part of the globe to another within a relatively short period.

3.2 Production of Foundation Certified Seed in Nigeria

Prior to the establishment of the national agriculture seed council in 1976, seed programs were sporadic and uncoordinated. The impact was restricted to the immediate environment of the existing research institute. Today the NASC has enjoyed the support of FAO/UNDP and the story has changed. There is now an organisation plan for multiplication of improved seed and adequate supply to areas of needs.

When an improved new variety has been subjected to the rigors of release by the national committee on registration of crop varieties, the breeder is requested to produce high quantity of the developed variety which is then sent to NASC for production of foundation seed. NASC, through the effort of direct farms and designated out-growers multiply these seeds which are then named foundation seed.

The foundation seeds are then supplied to the state Agricultural Development Project seed multiplication units bearing in mind ecological adaptation of the crop. The seed multiplication units of the ADP's in like manner, with the assistance of out-growers and their direct farms, further multiply these foundation seeds producing certified seeds. Which are now cleaned and distributed to farmers for mass production.

The success or failure of this programme hinges on two principle actors in the operation. These are:

The role of out-growers: - These are dependable farmers or seed companies who sign a seed multiplication contract with the ADP's on specific seasons. As terms of the contract, the farmer is supplied foundation seeds and some other inputs for production of the crop on loan. The farmer is also given technical advice by the ADP staff for production of the crop which he is obliged to take. At harvest the farmer is obliged to return all of his harvest to the ADP where the ADP buys the yield at a price at least 20% higher than the prevailing market price. The value of the seed and other inputs earlier supplied the farmer is however deducted during sales at source. The success of these system revolves round the selection of trusted cadre of out-growers for production of desired quality and quantity of seed. The Criteria for selection of competent out-growers is as follows:

(i) The grower should be an enlightened farmer ready to learn and adopt improved practices of high quality seed production.

(ii) The grower should have long term interest in the seed production activity
(iii) He should be able to develop facilities on his farm and bear losses due to rejection of seed by quality control.
(iv) His farm should be located in a compact area and easily accessible to facilitate technical guidance, supervision, field inspection and transportation of seeds.
(iv) He should be trusted and a farmer of proven probity

The role of quality control: -The quality control staff should have proper training and be provided with the following:
(i) Provision of logistics, updating and equipping seed testing laboratories at regional and state levels.
(ii) Enhanced funding for regular monitoring of various field and laboratory activities required for optimal certification activities.
(iii) Regular manpower development in various specialised areas of seed science and technology
(iv) The full description of every new cultivar and ones still in use being made available by each breeder.

SELF-ASSESSTMENT EXERCISE

What attributes will fully equip a quality control staff for his assignments?

4.0 CONCLUSION

The two fundamental bottlenecks to improved seed use by farmers in Nigeria are, low seed adoption rate (SAR) and low seed replacement rate (SRR). To rectify this situation, government has been advised to promote an aggressive programme to boost the consumption capacity of certified seed by farmers. Such a programme will go a long way towards bridging the gap between potential demand and effective demand which has been faulting our planting for a long time. In order to increase the SRR within a short period of time a community seed promotion programme using progressive farmers in a number of villages has been suggested.

5.0 SUMMARY

The relevance of improved seed to the realisation of the full agricultural potentials of any nation cannot be overemphasised. In Nigeria, foundation seeds are multiplied throughout-growers and direct effort. The selection of out-growers is based on merit and not favoritism. Quality control staff who act as a check on this system should therefore be properly trained and provided with adequate logistics for performance.

6.0 TUTOR-MARKED ASSIGNMENT

1. Give at least five reasons why improved seed are better than local seeds.
2. How are foundation and certified seeds produced in Nigeria?

7.0 REFERENCES/FURTHER READING

Adamu, A. et al. (1999). Seed Technology. A Manual for Varietal Maintenance and Breeder and Foundation Seed Production. Ibadan, Nigeria: African Book Builders Ltd.

Adedipe, O. N. et al. (1994). Evolving the Nigerian Seed Development Plan. The Federal Department of Agriculture, Abuja.

Subir, S. & Nabinananda, G. (2010). Seed Science and Technology. New Delhi, India: Kalyani Publishers.

UNIT 7 MAINTENANCE OF BASIC MAIDENS OR BREEDER SEEDS

CONTENTS

1.0 INTRODUCTION

Seed multiplication alone is not a difficult task. What makes it difficult is the ability to maintain the desirable qualities imbibed in the seed by the breeder in the subsequent generation or generations of multiplication.

The ability to multiply in such a way that the originality of the breeder is sustained in subsequent generation is a difficult task that requires careful techniques that vary with individual crops. It is a study of the techniques involved in this ability that is the main concern of seed science.

2.0 OBJECTIVE

By the end of this unit, you will be able to:

- explain the major techniques in seed production that are necessary for maintenance of seed purity.

3.0 MAIN CONTENT

Certain production practices which may appear to be more time and money intensive than the usual agronomic practices are very essential in seed production because they are designed to ensure the maintenance of seed purity in multiplication. The genetic purity of a seed crop lot refers to the trueness of that lot to the variety it represents. Each crop variety requires unique treatments to continuously maintain its purity, though the treatment may be relatively simpler in self-pollinated crops than in crops which are largely cross pollinated. The relevant treatments are:

1. Planting materials: The planting seed must be of a very superior quality. Seed quality is the most important attribute which distinguishes it from ordinary grain and therefore it must be guarded jealously all through the various operations in the course of seed production, conditioning and even in the marketing

channels. Seed quality is the physical, physiological, pathological and genetic attributes which contributes to final crop yield. A good seed must achieve the following attributes:

(i). Superior high yielding variety/hybrid.
(ii). Good consumer acceptability
(iii). Genetically pure
(iv). High germination percentage
(v). Free from seed born diseases.
(vi). Free from insect pests.
(vii). Free from other crop seeds.
(viii). Free from inert matter.
(ix). Attain safe moisture content.
(x). Good physical appearance.

2. Cropping history: The first step in production in site selection. For the purpose of seed multiplication, the history of the site be used must be known. This is important to avoid contamination from the previous crop where seeds may grow as volunteer crops in the new crop. A distinctive period of 2years must be maintained in a site previously cultivated with cereals before any similar cereal crops are grown there for seed multiplication, while not less than 5years fallow period is allowed for forage crops.

3. Isolation:- A crop of cross-pollinated species has to be protected against foreign pollen from adjacent crops or wild plants of the same species. This can be achieved in various ways such as:

(i). Isolation in time: This is achieved by growing the crop in such a way that it will flower at a time when other varieties of the crop are not flowering.
(ii). Isolation in space: on a small scale, single flowers or part or all of an inflorescence may be covered with an inverted plastic or paper bag. Whole plants can be protected by the use of wood or metal frames covered with plastic mesh to keep out pollinators. Large number of plants can be accommodated in an insect-proof glass house. On a large scale, isolation in space is achieved by putting various distances between plants. The distances required for this depend on species, topography of land, the surrounding vegetation, the prevailing winds direction, temperature, humidity, insect activity, natural barriers, border rows, differential flowering period, amount of pollen and size of the field. If the crop area is large and the margins are harvested for seed, the isolation distance may be reduced. When maintenance of genetic purity is required for rice, provide 3m isolation on all sides from any other sides from other rice. The distance is short because rice is self-

pollinated. Cowpea, through also self pollinated requires about 25m isolation.

Maize and sorghum being wind pollinated crops require wider isolation of 200 – 400m.

4. Rouging: This is an operation that is carried out by removal of unwanted seed crop from a crop field before any damage of contamination is done to the seed. Plants of the wrong cultivars either off-type or volunteer plants are referred to as rouges. The art of rouging is a highly skilled work and is only possible if the rouges are seen. The rouger therefore walks slowly backward and forward in parallel lines through the field uprooting the rouges. The characters to look for may vary with crop species. In cross-pollinated crops, rouging has to be completed before flowering so as to avoid any damage already done after flowering.

5. Handling care: Every equipment used must be cleaned and checked. Special modification may be installed in harvester to clean it before use. There is a lot to be saved by using simple and small machinery to facilitate cleaning. Hand processing techniques may be used on very small pre-basic seeds. This care should be extended to all stages of seed multiplication.

6. Limitation of generation of multiplication:- A general principle is to impose certain multiplication limitation on crop seed and beyond it no further multiplication is needed. The length of generation depends on the type of crop (breeding system) and the multiplication factor. Multiplication programme should not exceed its maximum generation so that the qualities of such seed crops are not affected

SELF-ASSESSMENT EXERCISE

Explain in details the cultural practices in production necessary in seed multiplication which may not be considered very necessary in normal agronomic production.

4.0 CONCLUSION

Seed of newly released variety is obtained from the breeder that developed the variety and this is called breeder seed. The breeder best knows the variety and is thus in the best position to maintain its genetic purity. It is important to try in all possible ways to maintain what was produced as breeder seeds because any contamination at whatever generation would have multiplier effect on all subsequent generations.

5.0 SUMMARY

Sources of contamination of improved seeds include physical mixtures with seeds of other varieties, out-crossing, mutation, weed and seed home disease and insect pests. Genetic impurities appear to be more troublesome in cross-pollinated than self-pollinating species; therefore, isolation distances are more in crossers, rouging of off-type at specific stages of crop development and some type of selection are other methods of maintaining genetic purity of breeder's seed. Isolation in space and/or time is inevitable in the production of breeder's seed, especially in cross-pollinated species.

6.0 TUTOR-MARKED ASSIGNMENT

List and explain the cultural practices in production necessary in seed multiplication which may not be considered very necessary in normal agronomic production.

7.0 REFERENCES/FURTHER READING

Adedipe, O. N. et al. (1994). Evolving the Nigerian Seed Development Plan. The Federal Department of Agriculture, Abuja.

MODULE 4 SEED PROCESSING

UNIT 1 DETERIORATION OF CROP VARIETIES AND ITS CONTROL

CONTENTS

1.0 INTRODUCTION

Seed deterioration simply means; the seed is losing its high quality value (i.e. the seed is getting bad). Seed deterioration can start from the field through insects and disease damage. Most seed deterioration occurs after harvest particularly in storage. Seed deterioration affects both the planting quality and marketing values.

In this unit, it is essential to examine:
1. Causes of seed deterioration on the field and in storage.
2. Consequences of seed deterioration, and;
3. Strategies to minimise seed deterioration

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- determine and know the factors affecting seed deterioration
- state the consequences of seed deterioration
- explain the strategies to minimise seed deterioration.

3.0 MAIN CONTENT

3.1 What is Seed Deterioration?

Seed deterioration is the loss of some or all the attributes that sum up to high seed quality. From the farmer's point of view however, seed deterioration simply means failure of seed to germinate. Deterioration of seeds has been known to be caused during all the stages of production i.e. post maturation, pre-harvest period, storage and marketing.

3.1.1 Causes of Seed Deterioration

Broadly, causes of seed deterioration are classified into two main stages, i.e. during production and during storage distribution/marketing.

Factors of Seed Deterioration during Production

(1) Quality of seed used for planting: Low quality seed deteriorates faster and do not perform well on the field.
(2) The amount of frequency of rainfall that prevails after seed has matured but is yet to be harvested influences the rate and severity of field deterioration due to weathering.
(3) Seed moisture: High seed moisture at harvest predisposes the seeds to mechanical injuries during threshing and shelling thus making way for invasion by insect pests and diseases.
(4) Drying temperature: When seeds are spontaneously exposed to high temperature for drying, their embryos are destroyed leading to consequent loss of viability. Artificial drying should therefore start with low temperatures and gradually rise to 42^{o}C.
(5) Delayed harvest: Once seed has attained physiological maturity, any further delay in harvest means the seeds are exposed to adverse weather conditions.

Seed deterioration factors during storage and distribution/marketing

1. Moisture content: Seed is hygroscopic so that its moisture content is in equilibrium with the ambient relative humidity. When relative humidity is high, seed moisture content is also high and vice versa. High seed moisture content with high temperature therefore accelerates seed deterioration.
2. Storage condition: The storage structures should be constructed to maintain a constant temperature and relative humidity since high relative humidity and temperatures favour growth of fungi and invasion by insect pests. The structure should also have a proof against rodents and other animals.
3. Poor handling during distribution: Leaking tarpaulins on transporting vehicles or trucks, broken containers, keeping seeds

in boot of cars for long periods, etc. could result in seed deterioration.

3.2 Consequences of Seed Deterioration

1. Loss of Germinability: From a farmer's point of view, loss of germinability is the most important effect that deterioration has on seeds. it may result to total crop failure and loss of confidence in the seed producing organisation.
2. Loss of vigour: When there is loss of vigour, there is no uniform growth and expected plant population per unit area is not attained.
3. Loss of gloss: The physical appearance of the seed is poor and this may affect the price since overall good appearance is an attribute of high quality seed.
4. Increase in diseased seeds: This is brought about because of infestation by insects and diseases.

3.3 Strategies to Minimise Seed Deterioration

1. Timely harvesting: Once a crop seed has matured on the field, any delay in harvesting is regarded as storage in the open where the seed is subjected to adverse weather conditions and attack by fungi, insects, birds, rodents, etc. harvest operation should be conducted as soon as the seed has matured.
2. Timely drying: Usually, seeds are harvested when the moisture content is still high (16 – 25%). If the moisture content is not reduced for a long period, it would deteriorate. Moisture content should immediately be reduced to 13% or less for non-oil seeds and 11% or less for oil and vegetable seeds. Precaution should be taken not to cause thermal injury to the seeds.
3. Production in areas with comparative advantage: areas with high rainfall and high relative humidity favour the development of pathogens and so seeds produced in such areas are more vulnerable to attack. It is therefore advisable to establish a seed industry where the weather conditions are favourable.
4. Off-season seed production: Dry season production under irrigation is most favourable for majority of the crop seeds. This is because, the dry season does not provide a favourable atmospheric condition for pathogens.
5. Use of resistant seeds: The seed producer should seek information about resistant strains or varieties and use them.
6. Good storage condition: A good structure should maintain a cool and dry condition with proof against insects and rodents.

SELF-ASSESSTMENT EXERCISE

1. What are the consequences of seed deterioration?
2. What strategies can be used to minimise seed deterioration?

4.0 CONCLUSION

Seed is the most basic input in crop production since 40 – 50% productivity gain arises from use of improved seed. Seed is a biological entity, which germinates under favourable conditions. Seed quality is the sum of many seed attributes that include:

- High germination percentage
- Genetically pure
- Safe moisture content
- High seedling vigour
- Free from insect pests and seed borne diseases
- High analytical purity
- Field inspected, tested, packed, labeled, sealed and certified

It is therefore essential that seed officers should provide farmers with high quality seeds to improve their productivity, income and standard of living.

5.0 SUMMARY

Seed deterioration starts in the field when physiological maturity is about 18 – 25%. Factors that tend to worsen seed deterioration include delayed harvesting, mechanical damage and insect pests and diseases. Seed deterioration during storage may arise from inadequate drying (high moisture content) of seeds prior to storage, poor storage conditions, etc. Four consequences of seed deterioration and six strategies for prevention are hereby outlined.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is seed deterioration?
2. Explain the factor of seed deterioration during production.
3. Explain the factors of seed deterioration during storage and distribution/marketing.

7.0 REFERENCE/FURTHER READING

Utoh, N. O. (1998/99). Seed Deterioration as it Affects Seed Quality. Course Proceedings in Comprehensive Training in Seed Certification. Vol. 1 (FDA/National Seed Service) FAO of United Nations.

UNIT 2 SEED DRYING

CONTENTS

1.0 INTRODUCTION

Usually, freshly harvested seeds contain high moisture content, trash and other inert material, weed seeds, deteriorated and damaged seeds. If all these are bundled together for further use, it would create untold hardship for whatever operation the seeds are expected to be used for. It is desirous that farmers would process their seeds before being forwarded for any further use. Processing is necessary in order to dry the seed to a safe moisture level, remove or reduce to the extent possible the various undesirable materials, weeds seeds, other crop seeds, deteriorated or damaged seeds, uniform size grading and seed treatment to upgrade the overall seed quality. Seed processing therefore refers to all the steps necessary for preparation of harvested seeds for marketing.
These steps include: Handling, drying, shelling, preconditioning, cleaning, size grading, treating and packaging. We shall however be discussing drying and packaging only in this module.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain what drying of seeds means
- analyse why it is better to use artificial drying methods than depend on natural drying
- explain the disadvantages of traditional drying techniques.

3.0 MAIN CONTENT

3.1 Seeds Drying

Drying is the procedure used to remove excess moisture from the seed to reduce moisture to a level acceptable for safe storage or for commercial sale. The drying of seeds is the most important operation in seed processing. Drying of seeds to a safe moisture level for subsequent processing operations and storage life is a critical step. After putting all efforts to planting, growing and harvesting the crops, unless the seed is dried fairly rapidly to a safe moisture content level for storage, the high rate of respiration and mould growth will cause overheating resulting in rapid loss of viability. Drying of seeds may be natural or artificial.

3.2 Natural Seed Drying

Air temperature, air movement and relative humidity as well as state of seed maturity at harvest of seed crop are the controlling factors for natural seed drying. When seeds are harvested in the dry season, these factors help to dehydrate the seeds spontaneously to safe moisture content. Usually higher temperature with lower humidity and steady flow of air surrounding the seed surface would facilitate withdrawal of water from the seed. However, where this favourable conditions do not prevail, seeds are spread in a thin layer and exposed to sun for natural/normal flow of dry air. The disadvantages of traditional drying techniques include:

1. There is little or no control over the drying crop rate.
2. It is not possible to ensure uniform drying because of the varying thickness of the piled crop.
3. Over drying occurs in arid regions due to excessive exposure to sun or heat causes breakage of the seed coat, bleaching, scorching, discoloration, loss of germination power and nutritional changes.
4. Very rapid drying of crops with high moisture content can cause damage such as hardening of the case followed by bursting. This is because the surface of the grain dries out rapidly, thus sealing moisture within the inner layers, which may cause the grain to burst as the temperature rises.
5. Under drying or slow drying as a problem in humid regions, it results in deterioration of food due to fungi and bacteria attack.

3.3 Artificial Seed Drying

Where natural conditions do not favour easy drying of harvested seed, it is extremely important to plan for adequate drying facilities along with any seed production programme. In general, seeds are best dried in a drying room at 15^{o}C and 10% to 15% relative humidity. The drying room should have refrigeration and air dehumidification and good air

recirculation facilities to lower the temperature and RH from the ambient condition.

Some of the most artificial drying facilities offer the following advantages:

1. Permits early harvest which reduces the field loss of products from storm and natural shattering and allows working the soil for the next crop
2. Make better planning of the harvest season for the more efficient use of labour. Farm crops can be harvested when natural drying conditions are unfavorable.
3. Allows long time storage with little deterioration. Extended storage periods are becoming increasingly important with the large amount of grains being stored through another storage year by the farmer, government and industry,
4. Drying gives the opportunity of taking advantage of higher price a few months after harvest. Although in some years, there may be no price advantage.
5. Drying permits the maintenance of the viability of seeds. By moisture removal, the possibility of the grain heating up is reduced which may cause reduction in germinability.
6. Gives the farmer the joy and satisfaction of selling a better quality product.
7. Proper drying inhibits germination and prevents the growth of fungi and bacteria while in storage.
8. It retards attack on seeds by mites and insects.

SELF-ASSESSTMENT EXERCISE

Explain Why is it extremely important to plan for adequate drying facilitates along with any seed production programme?

4.0 CONCLUSION

Seeds should be dried as soon as they are harvested or received. If this is not possible, the seed should be placed in the bin equipped with sufficient fan capacity to aerate the seed until drying. Aeration will prevent heating. Which may cause irreversible damage to seed viability.

5.0 SUMMARY

Drying of seed lots i.e. lowering down the seed moisture content to safe moisture limits is very important in order to maintain seed viability and vigor, which may otherwise deteriorate fast due to mold growth, heating and increased micro-organism activity. Drying of seeds may be conducted by spreading the seeds in a thin layer under the sun to be dried natural by

drying air artificial drying should be employed. It is more advantageous to plan for and conduct artificial drying than to depend on natural drying.

6.0 TUTOR-MARKED ASSIGNMENT

1. Why is it extremely important to plan for adequate drying facilitates along with any seed production programme?
2. What are the disadvantages of traditional drying techniques?

7.0 REFERENCES/FURTHER READING

Irtwange, S. V. (1998/99). Seed Harvesting and Drying Operation. Course Proceedings in Comprehensive Training in Seed Production, Storage Distribution and Marketing. FAO (FDA/National Seed Service) vol. 11

Subir, S. & Nabinananda G. (2010). *Seed Science Technology*. New Delhi, India: Kayani Publishers.

UNIT 3 SEED PACKAGING PURPOSES, TYPES AND COST IMPLICATION

CONTENTS

1.0 INTRODUCTION

From time immemorial, seeds were packaged from place of harvest in order to make it convenient to transport either to the house for food or storage, industry for processing, market for sale or to the farm where they would be planted. Low cost, and easy to handle packaging materials like clay jars, woven grass or cane baskets and leather bags were used for transportation. Scientific advancements in agriculture have now provided improved packaging materials than what was previously in use. Modern packaging materials and methods, which have the ability to preserve seeds better at affordable cost, are now in use.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- state the reasons for packaging seeds and the factors affecting the kind of container to be used
- explain the types of packaging materials and the equipment for packaging.

3.0 MAIN CONTENT

After processing and treatment of seeds, they are packaged into containers of specified weight (e.g 10kg, 20kg, 50kg) before being stored, pending distribution and marketing. Packaging or bagging is essentially the last operation in which seeds are handled in bulk flow. Packaging and safe storage is an integral part of seed processing.

The package should retain the seed in a convenient form, possibly act as dispensable and be suitable for easy disposal and re-use. In addition, the package should not influence the product. The seed package is a small storage container and the choice of the kind of container should be guided by these factors:

(i) The quantity of seeds desired to be in each package.
(ii) The protection desired
(iii) The cost of the package
(iv) The value of the seed

3.1 Reasons for Packaging Seeds

Packaging of seeds is done mainly for the following reasons:
(i) To facilitate handling and storage
(ii) To comply with legal requirements
(iii) To preserve viability and seed quality
(iv) To produce a presentable product for selling
(v) To maintain varietal and lot identity
(vi) To provide seed in popular sizes to cover a desired area (i.e. acre or hectare)

3.2 Types of Packaging Materials

Cost and availability of material have been the major considerations in determining what to use. Cereal sees have commonly been packaged in cotton, jute and paper bags. Moisture vapour penetrates all these containers and they offer no protection against high relative humidity. They require dry warehouses and storage conditions that will keep the seed from acquiring moisture levels above 12% until use. Where these requirements can be satisfied, as is often the case, the use of cotton, jute and paper bags is probably the most satisfactory material for seed packaging.

In high relative humidity locations with inadequate seed storage facilities, considerations should be given to packaging materials which can protect the seeds from moisture vapour. The cost of most moisture proof packaging materials has been considered too high for the packaging of cereal seeds. Nevertheless, the advantages of moisture proof packaging in terms of seed viability and less exacting storage requirements, justify serious considerations of various alternatives. Polyethylene bags have been regarded as the most attractive in these various possibilities because of their relatively low cost compared to other kinds of sealed containers.

3.3 Equipment for Packaging

The equipment used for packaging are referred to as bagger weigher. These are small machines which when properly mounted beneath a bin, will fill and weigh a bag accurately in a single operation. Bagger weigher and bagging scales used in seed packaging may be manual, semi-automatic or automatic.

1. **Manual weighing:** This type of scale, usually a portable platform is considered inefficient for volume operations because of high labour requirements and relatively low capacity, in terms of bags filled per minute. With this scale, bags are filled in approximate weight, placed on the scale and then 'even weighed' with a hand scoop.
   These bags are useful in the following conditions:
   (a) Weighing bags of non-free flowing seeds
   (b) A bagging bin or processing machine is not available.
   (c) Labour costs are minimal

2. **Semi-automatic:** This is most widely used scales. The scale is attached to the bottom of a bagging bin, and the bag is clamped to the bottom of the scale. The feed gate is opened manually and may be closed either manually or automatically when the proper weight is attained. The scales have the capacity to weigh four to eight bags of 50k per minute depending on the seed being packaged and the skill of the operators.

3. **Automatic scales:** Scales of this type are used primarily for small packages e.g. vegetable and lawn seeds. In these machines, the entire weighing and filling is done automatically. Installation is similar to the semi-automatic bagger. Some completely automated systems pick up the empty bag; place it on the bagger, fill the bag and releases the filled bag which then moves by conveyor to a bag closer.

Several types of conveyors are available for moving seed into, through or away from the processing plant in vertical, horizontal or inclined directions. Selections of conveyors that have adequate capacity do little damage to seed and are easy to clean, can have an important influence on processing effectiveness and efficiency. Examples:

- Bucket elevators
- Belt conveyors
- Vibrating conveyors
- Pneumatic conveyors
- Screw conveyors
- Chain conveyors
- Lift trucks

SELF-ASSESSTMENT EXERCISE

Discuss the modes of operations of the three different bagger weighers and bagging scales used in seed packaging.

4.0 CONCLUSION

Seed packaging as earlier stated is an integral part of seed processing which must not be handled with levity. Apart from the quality and viability it preserves, it also provides convenience and makes the product presentable for marketing.

5.0 SUMMARY

Convenience was the only reason our forefathers had for using the kind of packaging materials they used in those days. We know now that there is more to it than just convenience. Where the cost is not too high therefore, we therefore use highly standardised packaging materials to preserve seeds. Mechanically designed equipments have also been provided with reduced cost and less labour for seed packaging.

6.0 TUTOR-MARKED ASSIGNMENT

1. What factors will determine your choice of packaging materials?
2. Why are seeds packaged?
3. List the types of packaging materials commonly used today and explain what reasons you would have for using all of them.

7.0 REFERENCES/FURTHER READING

Agrawal, R. L. (2005). Seed Technology (2nd ed.). New Delhi: Oxford & IBH Publishing Co. PVT Ltd.

Subir, S. & Nabinananda G. (2010). Seed Science Technology. New Delhi, India: Kayani Publishers.

MODULE 5 SEED CERTIFICATION

UNIT 1 OBJECTIVES AND PRINCIPLES OF SEED CERTIFICATION AND QUALITY CONTROL

CONTENTS

1.0 INTRODUCTION

Seed producers must get their farms certified and so they are more concerned about seed certification. Their farms must conform to seed certification standards, failure to meet standards will lead to rejection of their produce.

Farmers producing grains for consumption only focus on getting certified seed as planting material for high productivity.

Certification therefore stands as a necessary tool for every farmer that produces. It is therefore important that all farmers are well knowledgeable in seed certification procedures and standards.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain what seed certification means
- state its objectives
- list the steps involved in the organisation of seed certification

- discuss the principles used in organising a seed certification agency.

3.0 MAIN CONTENT

3.1 Objectives of Seed Certification

The objective of seed certification is to ensure genuineness and quality of seed to the purchaser. A well-organised seed certification is actually the guardian of pure good quality seed supply. A well organised seed certification system helps in accomplishing the following three primary objectives of seed programmes.

1. The systematic increase of superior varieties.
2. Field inspection: Inspection of the growing crop at various stages to ensure that isolation of seed crop, rouging of off-types, objectionable weeds and other admixtures are properly controlled.
3. Sample inspection by laboratory tests of a representative sample drawn to determine the percentage germination, moisture content, weed seed content, admixture, purity tagging and labeling to identify the seed and sealing.

3.2 Organisation of Certification

The various steps require for organising seed certification according to statutory rules and regulations are:

1. Establishment and operation of Seed Certification Agency
2. Establishment of minimum seed certification standards
3. Establishment of procedures for field inspections, seed processing, seed sampling and testing and issuance of seed tags and seals.

Pertinent data to be taken while conducting seed certification on the field include: Farm size, variety name, seed producer’s level of education and experience.

The typical organisation of a seed certification agency has a board of directors, basic technical and other staff and other facilities for operating the programme. A seed testing laboratory may or may not be required by the certification agency in case it decides to get its seed samples tested through a state seed laboratory. Figure 1 is a sample-staffing pattern of a seed certification agency.

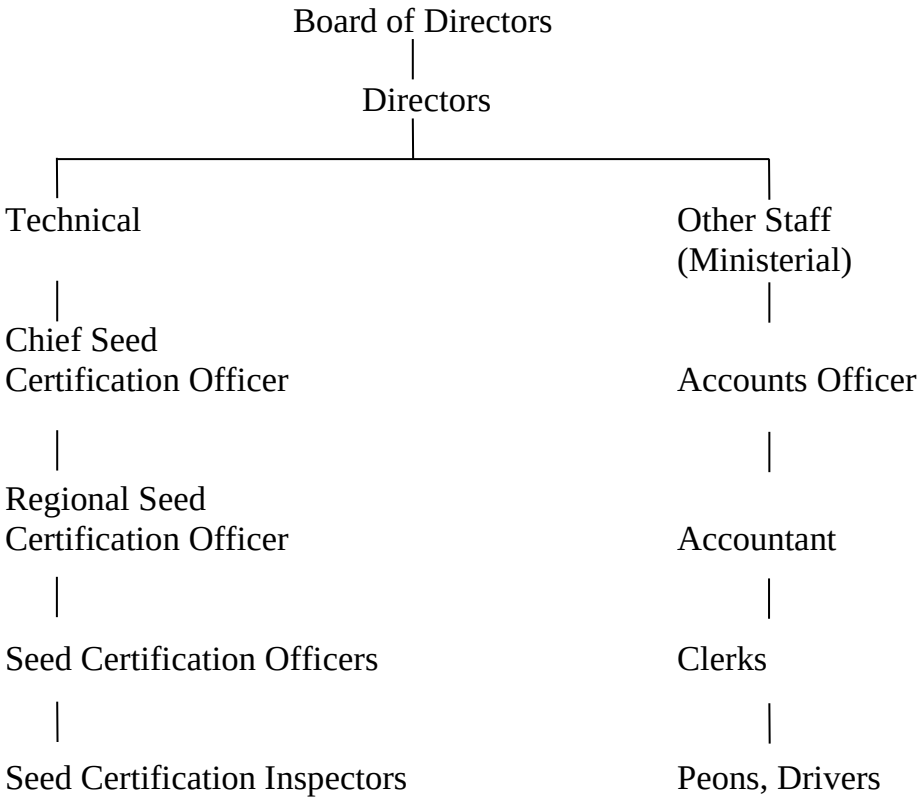

Fig. 1.1: Sample Staff Organisational Organogram of a Seed Certification Agency

3.3 Principles of Seed Certification

The broad principles for forming a seed certification agency are as follows:

1. A seed certification agency should not be involved in production and marketing of seeds.
2. A seed certification agency should have autonomy
3. The seed certification standards and procedures adapted by seed certification agency should be uniform, i.e. the same standards and procedures should be adopted throughout the country.
4. A seed certification agency should be closely associated with other Institutes.
5. Adequate staff trained in seed certification should be maintained by the certification agency.
6. It should have provision for creating adequate facilities for ensuring timely and thorough inspection.
7. It should have the interest of seed producers and buyers.

SELF-ASSESSTMENT EXERCISE

In your own understanding, explain what are the principles of seed certification?

4.0 CONCLUSION

Seed certification, agency should be independent. Seed certification agency should be able to inspect and give an unbiased assessment of the quality of seed farm inspected.

5.0 SUMMARY

Seed certification is established by law. This means any farmer who wants to multiply seeds must be ready to comply with the laid down procedures. Where the farmer's seeds or produce is rejected by certification officers, he should be ready to accept losses. certification agencies must also keep to the tenets of their profession, unbiased, and ensure thorough inspection detect objectionable production tendencies and provide corrections where applicable but should not hesitate to reject when the farms do not comply with the set standard.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is seed certification? How does certification monitor or control the seed multiplication protocol.
2. What are the objectives of seed certification? What are the steps required in its organisation?

7.0 REFERENCES/FURTHER READING

Agrawal, R. L. (2005). Seed Technology (2nd ed.). New Delhi: Oxford & IBH Publishing Co. PVT Ltd.

Subir, S. & Nabinananda G. (2010). Seed Science Technology. New Delhi, India: Kayani Publishers.

UNIT 2 PROCEDURES FOR FIELD INSPECTION

CONTENTS

1.0 INTRODUCTION

People generally have an erroneous feeling when mixture of seeds is mentioned that it must have occurred during processing. Mixture of seeds however occurs at all stages of production. Field inspection is one of the most important activities of seed certification, without which it would be difficult to determine the genuineness of the seed produced. There is therefore a procedure for conducting the exercise. The objectives of seed certification, general principles and stages of field inspection will be discussed in this unit.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- state the objectives of field inspection
- explain the general principles of field inspection
- discuss the method of inspection.

3.0 MAIN CONTENT

Field inspection is the inspection of standing crops to verify conformity to prescribed certification standards. Seed certification agency staff usually make field inspections at appropriate stages of crop growth to ensure that the minimum standards for isolation, preceding crop requirement, rouging and other special operations are maintained at all times. These field inspections are designed to ensure that the seed field meets the minimum standards for certification. All such seed fields which do not meet any of the standards are eventually rejected. The field inspections are done to achieve the following objectives:

1. To verify seed origin (seed source) and identity of the variety.
2. To collect information on cropping history of the seed field, i.e. to verify whether the seed filed meet the prescribed land requirement
3. To check isolation distance
4. To check crop and cultivation conditions
5. To check freedom from impurities, namely, other crop plants and weed plants
6. To check freedom from other cultivars and off-types
7. To check freedom from seed borne diseases

The field observations made for the above mentioned factors are compared with a set of prescribed standards (Minimum Seed Certification Standards) which are specific for each crop.

3.1 General Principles of Field Inspection

These principles are general and apply to most crop plants.

1. All field inspections must be conducted by well trained and qualified personnel.
2. The minimum number of prescribed procedures and techniques should be strictly adhered to.
3. Some surprise inspections could be made without prior notice to the grower or farmer. Advance notice inspections are however, advantageous because they facilitate exchange of information and correction of minor deficiencies.
4. The seed inspector should maintain a cordial relationship with seed growers even in situations where a grower's field is rejected. This is necessary for a smooth operation of a certification scheme.
5. It is advisable to walk and observe the borders of the seed field round before entering into the farm to check all other information about the crop e.g. variety, seed origin, cultivated area, class of seed, cropping history and cops planted in adjacent fields.
6. More than one inspection is required for each field and commencement of inspection during each visit should be at different points. The schematic pattern of walking in the field to ensure proper coverage is as shown in Figure 2.
7. If the direction of rows permits, the inspector should walk through his side or back.
8. For short crops, the inspector should squat or bend periodically during inspection so that eye level observations can be made at the top height of plants.
9. If at any given inspection, the seed crop does not conform to the prescribed standards further inspection need not to be made unless the seed crop is eligible for re-inspection after removal of contamination factors. However, if it is observed that contaminating factors and contaminated materials could make the

seed crop conform to the prescribed standard, their removal from the field may be recommended or permitted.

10. On completion of field counts, if it is observed that the contamination factors are localised in certain patches, or in parts of the field, and it is felt that rouging in such patches is relatively poor, the inspector may check the entire rows of which the patch is a part. He should then prepare a map indicating the approximate route followed for counting in the field, and the number of contaminating factors observed in each count. Such a map may help in saving a part of the field.

3.2 Method of Inspection

The inspections of seed crop are done at different stages of crop growth. We shall therefore discuss here the various crop stages for inspection.

Stages of Field Inspection

1. **Inspection at the time of sowing**: The purpose of this inspection is to explain to the farmers the land and isolation requirements, to check whether their seed is from the correct source, seed treatments and other cultural practices recommended for sowing.
2. **Inspection during pre-flowering/vegetative stage**: This is the growth phase from seedling to flower bud initiation or flag leaf emergence. The purpose is to educate and advice the farmers about rouging and keeping count of the disease infected plants.
3. **Inspection during flowering stage:** This is the critical stage to assess genetic purity and uniformity. It is done to check if various corrective measures, if suggested earlier have been carried out and to advice the farmer to continue roguing during flowering stage.

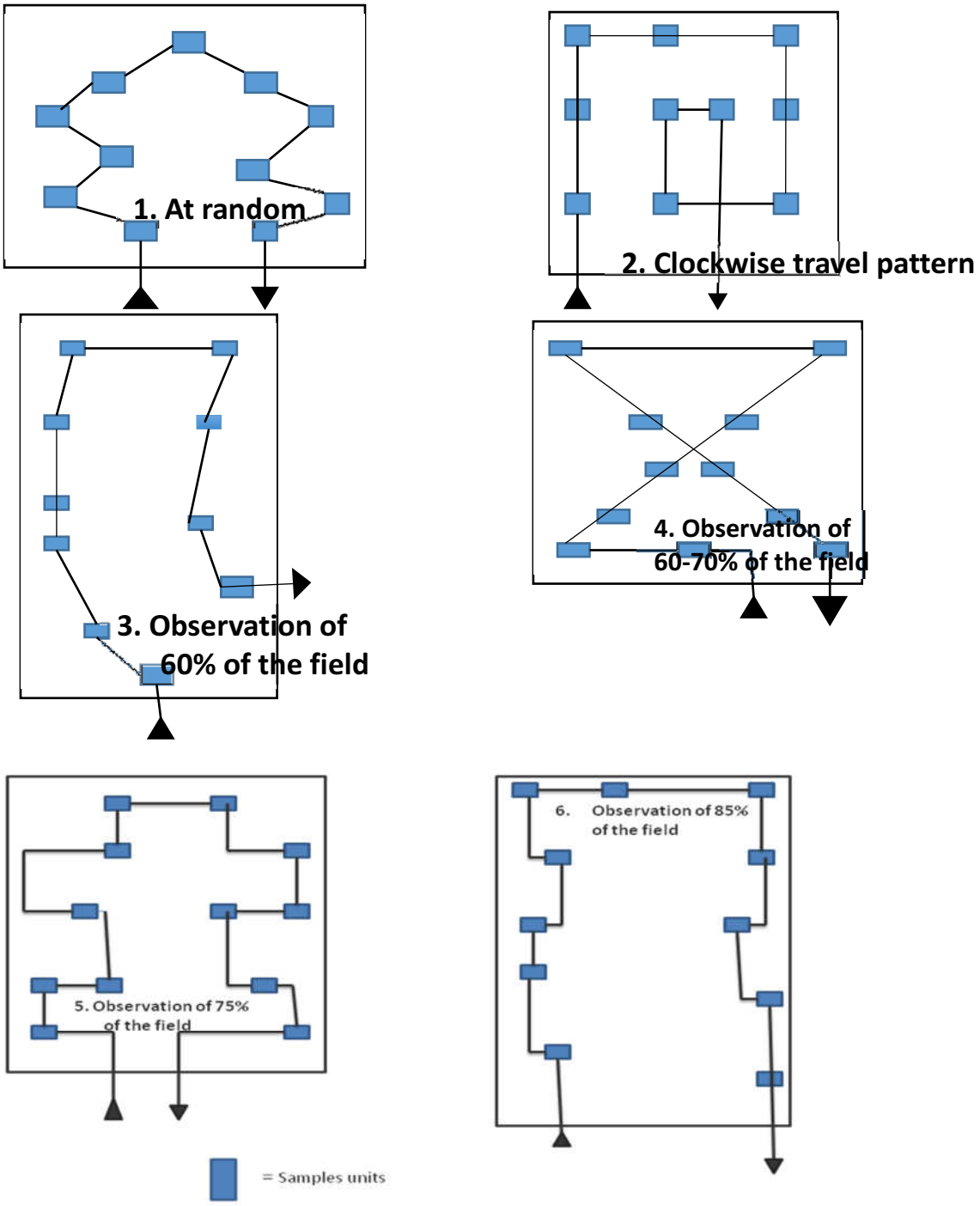

Fig. 2 Travel pattern of field inspection

4. **Inspection during post-flowering and pre-harvest stage:** The purpose is to take detailed counts to determine the extent of various contaminants that may have escaped the attention of the grower and to educate him about rogues which were not identifiable earlier so as to remove them before final inspection.
5. **Harvest time inspection:** This is the final inspection and it is done to determine if all the factors of control were rigorously followed and to check if the seed crop has met the requisite field standards. If the seed crop meets the requirement, the farmer should be given necessary advice on threshing and supply of the harvest to processing plants.

SELF-ASSESSTMENT EXERCISE

For what reasons and at what stages of crop growth are seed inspections expected to be undertaken by certifications inspectors?

4.0 CONCLUSION

Perfection in seed certification is not achieved by well trained and properly equipped personnel alone. Concern and determination to do the right thing must also be the watchword of the inspectors otherwise all the effort would be a waste.

5.0 SUMMARY

The main objective of seed inspection is to ensure that the multiplied seed meet up with the minimum seed certification standards set for each crop. These standards include factors like seed source, history of planting field, isolation distance etc. Inspections must therefore be guided by certain laid down principles and be conducted at five different stages of crop growth.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is field inspection? State its objectives
2. What are the general principles of field inspection?

7.0 REFERENCES/FURTHER READING

Agrawal, R. L. (2005). Seed Technology (2nd ed.). New Delhi: Oxford & IBH Publishing Co. PVT Ltd.

Subir, S. & Nabinananda, G. (2010). Seed Science and Technology. New Delhi, India: Kalyani Publishers.

UNIT 3 SEED CERTIFICATION STANDARDS

CONTENTS

1.0 INTRODUCTION

The purpose of seed certification is to maintain and make available to the public sources of high quality seeds and propagating materials of notified superior varieties grown and distributed so as to ensure genetic purity. A lot of years, hard work and funds are always involved to breed and produce a novel crop variety with its outstanding distinguishing characteristics. In order to benefit from all these years of hard work of variety development and maintenance, seed has to be multiplied under vigorous, controlled conditions. As a step towards achieving a high quality seed, certification agencies have set minimum quality standards for each class of seed with which each seed field and seed class must comply before it can be approved.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- identify the major factors in seed certification
- state how to write a standard application for certification
- identify the minimum certification standards for individual crops.

3.0 MAIN CONTENT

3.1 The General Standard

The general standards apply to all crops eligible for certification. Before discussing the general standards, it is necessary to remind ourselves about the three major factors in certification, these are:

1. Purpose of certification: Seed certification in Nigeria is designed to make available to the public high quality planting materials.

2. The agency responsible for certification: The National Seed Certification Agency (NASC) is responsible for seed certification in Nigeria.
3. Eligibility of crops/varieties for certification: In the seed certification scheme of Nigeria, only seeds of crop varieties which are registered, released and notified under section 7 of the Seeds Decree No. 27 of 1992 are eligible for certification. The eligible crops are hereby listed in Table 2.

Table 2: Crops/Varieties Eligible for Certification

S/No.	Name of Crop	Botanical name
	Cereals	
1.	Maize	*Zea mays* L.
2.	Millet	*Pennisetum maricanu* (L.) Leek
3.	Rice	*Oryza sativa* L.
4.	Sorghum	*Sorghum bicolor* (L,) Moench
5.	Wheat	*Triticum* Spp.
Legume		
6.	Cowpea	*Vigna unguiculata* (L.) Walp
7.	Soybean	*Glycerine max* Merr.
Oil crops		
8.	Cotton	*Gossypium* SPP.
9.	Groundnut	*Arachis hypogeal* L.
10.	Sunflower	
Root and tuber crops		
11.	Cassava	*Manihot esculentus* Crantz
12.	Irish potato	*Solanum tuberosum* L.
13.	Sweet potato	*Ipomea batatas* (L.) Schott
14.	Yam	*Dioscorea* Spp.
Vegetables		
15.	Amaranth	*Amaranthus* Spp.
16.	Celosia	*Celosia* Spp.
17.	Chorchorus	*Chorchorus* Spp.
18.	Cucumber	*Cucumis sativa* L.
19.	Onion	*Allium cepa* L.
20.	Pepper	*Capsicum* Spp.
21.	Solanum	*Solanum* Spp.
22.	Watermelon	*Citrullus lanatus* (Thumb)
23.	Tomato	*Lycopersicum esculentum* Mill
24.	Okro	*Abelmoscus esculentus* (L.) Moench
25.	Eggplant	
Exotic crop varieties		
1.	Beans	*Phaseolus vulgaris* L.
2.	Cabbage	Brassica *olerace* (L.) Var Capitate L.
3.	Carrot	*Daucus carate* L.

4. Cauliflower *Brassica oleracea* (L.) Var botrytis L.
5. Pea Pisum *sativum* L.

3.2 Application for Certification

A grower intending to have his seed crop inspected must obtain an application for certification from the Certifying Agency/Certification Officer. The application must be completed giving the following information, name of grower, address of grower, crop species, cultivar to be grown, class and seed source (a certification tag must be attached to the application as proof that seed source is authentic). Cropping history and or proposed date of planting must be indicated. Completed application form accompanied with certification fees must be submitted to the certifying agency before the deadline.

The application received by the certifying agency is scrutinised by officials of the agency and if the grower meets all necessary conditions for certification, the field is approved for certification. A copy of the approved application is sent to the grower as notification for acceptance.

3.2.1 Unit of Certification

For the purpose of field inspection, the entire area planted under seed production by an individual shall constitute one unit provided:

1. the entire area is under one variety
2. it does not exceed ten hectares
3. it is not divided into fields separated by more than fifty meters between them
4. it is planted with or is meant to produce seed belonging to the same class of and stage in the generation chain
5. the crop covering the entire area is more or less of the same stage of growth so that observations made are a representative of the entire crop.
6. the total area planted by and large corresponds to the quantity of seed reported to have been used.
7. the crop is raised strictly as a single crop and never as mixed crop.
8. the field is not so heavily and uniformly lodged so that more than one third plant population is trailing on the ground leaving no scope to stand again, thus making it impossible for the certifying inspector to inspect the seed crop at appropriate stage of growth in the prescribed manner.
9. as far as possible, so maintained to show adequate evidence of good crop husbandry, thereby improving the reputation of certified seed.

3.3 Minimum Standards for Certification of Individual Crops

Table 3: Minimum Standards for Certification of some Eligible Crops in Nigeria

Crops	**Class of seed**	**Isolation distance (Meters)**	**Pure seed (max) %**	**Inert matter (max) %**	**Other crop seed (max) (kg)**	**Total weed seeds (max) (kg)**	**Objectionable Weed seeds (max) (kg)**	**Germination %**	**Moisture (max)**
Maize	F&CS	400	98	2.00	10	-	-	90	12.0
Millet	F&CS	400	98	2.00	10&20	10&20	-	75	12.0
Rice	F&CS	3	98	2.00	10&20	10&20	2 & 5	80	13.0
Sorghum	F&CS	200	98	2.00	10&20	5&10	-	75	12.0
Wheat	F&CS		98	2.00	10&20	10&20	2 & 5	85	12.0
Cowpea	F&CS	25	98	2.00	&10	-&10	-	75	9.0
Soybean	F&CS		98	2.00	&10	5&10	-	70	12.0
Cotton	F&CS		98	2.00	&10	5&10	-	65	10.0
G/nut	F&CS		96	4.00	&	-	-	70	9.0
Sunflower	F&CS		98	2.00	&	5&10	-	70	8.0
Amaranth	F&CS	400	98	5.00	5&10	10&20	5 & 10	70	8.0
Celosia	F&CS	250	95	5.00	5&10	10&20	5 & 10	70	9.0
Corchorus	F&CS	200	97	3.00	5&10	10&20	-	80	7.0
Cucumber	F&CS	700	97	2.00	5&10	-	-	60	8.0
Onion	F&CS	600	98	2.00	5&10	5&10	-	70	8.0

Pepper	F&CS	250	98	2.00	5&10	5&10	-	60	
Solanum Spp.	F&CS		98	2.00	5&10	-	-	70	8.0
Tomato	F&CS	100	98	2.00	5&10	-	-	70	8..0
Watermelon	F&CS	700	98	2.00	&	-	-	60	7.0
Okro	F&CS	500	98	2.00	- &5	-	-	65	10.0
Eggplant	F&CS	700	98	2.00	5&10	-	-	75	8.0
Beans	F&CS	25	98	2.00	5&10	-	-	80	11.0

SELF-ASSESSTMENT EXERCISE

What are the three major factors in seed certification? List at least two crops each in the following categories that are eligible for certification in Nigeria: cereals, legume, oil crops, root and tuber crops and vegetables.

4.0 CONCLUSION

Seed certification took off in Nigeria in 1976 as an internal quality control programme of foundation seed production by the then National Seed Service. With the growing interest of the private sector in seed production, the sudden increase in demand for high quality seeds of improved crop varieties and the multiplication of seed agencies in Nigeria. National Seed Certification Agency that is independent of production and marketing was established. Field inspection and seed testing services are now provided by the programme at nominal fees which are being charged in phases towards cost recovery.

The proportion of crop hectarage planted with certified seed keep increasing with each additional year. The large increase in numbers and sources of new varieties has resulted to difficulties in determining their eligibility for certification and in developing adequate descriptions. Certification has however, provided immense benefits to Nigerian agriculture and has been accepted by farmers and the seed trade.

5.0 SUMMARY

In this unit we have discussed the purpose for which certification is conducted and identified the crops that are eligible for certification. An application is usually written by the farmer to the seed certification inspector who approves the application before inspection is made after payment of a statutory fee by the farmer. Prominent among the conditions for acceptance of a seed farm for one unit of certification are that the farm should not exceed 10ha and should contain only one variety planted at the same time to ensure uniformity. The minimum standards for certification of individual crops are as stated in Table 3.

6.0 TUTOR-MARKED ASSIGNMENT

1. What are the three major factors in seed certification? List at least two crops each in the following categories that are eligible for certification in Nigeria: cereals, legume, oil crops, root and tuber crops and vegetables.
2. What conditions would determine the acceptance of a farmers' field for certification as a single unit?

7.0 REFERENCES/FURTHER READING

Adedipe, O. N. et al. (1994). Evolving the Nigerian Seed Development Plan. The Federal Department of Agriculture, Abuja.

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UNIT 4 SEED TESTING PROCEDURES

CONTENTS

1.0 INTRODUCTION

Seed testing is an important aspect of quality control in any seed programme. It is the basis for distinguishing good seed from substandard seed. Seed is tested to determine its quality or suitability for planting. The science of seed testing or evaluating the planting value of seeds has been developed to minimise the risks associated with planting low quality seeds.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain the objectives of seed testing
- discuss the terminologies or terms used in seed testing
- state the procedures for seed testing.

3.0 MAIN CONTENT

3.1 Seed Quality Tests in Laboratory

Many tests are conducted in the laboratory to determine the standard attained by seed of different producers for suitability for planting. These tests are:

(i) moisture content of the seed
(ii) Physical purity
(iii) Germination capability

(iv) Inert matter
(v) Weed seed
(vi) Other crop seeds

3.1.1 Definition of Terms

In order to understand fully what is involved in seed testing, one has to be conversant with some common terms used in the process. These include:

1. International Seed Testing Association (ISTA): This is an international body established in 1924 with the primary objective of providing standard procedures for sampling and testing seeds and promoting a uniform application for evaluation of seeds moving in the international seed trade.
2. Seed lot: This is used to describe a specified quantity of seed which is physically identifiable to the type for which a certificate may be issued. Seed lot is usually identified by numbers referred to as Lot number.
3. Primary sample: This is a small portion of seed sample drawn at each point or position on the lot.
4. Composite sample: This is a mixture of the primary samples taken from the seed lot.
5. Submitted sample: The samples submitted to the Seed Testing Laboratory are coming from composite sample. The quantity usually submitted should be in larger quantity than that is needed for testing.
6. Working sample: This is a reduced quantity of sample taken from a submitted sample in the laboratory for use in a given quality test.
7. Sealed sample: This is a seed sample drawn and kept in a container which is sealed in such a way that it cannot be opened and closed again without leaving evidence of tampering.

3.2 Procedures for Seed Testing

3.2.1 Seed Sampling

It is not possible to test every seed in the lot in order to determine the quality. Samples that truthfully represent the seed lot are therefore taken for onward delivery to Seed Testing Laboratory for analysis. The submitted sample must be registered by the Laboratory technician or receptionist. A registration or reference number is assigned.

3.2.2 Sample Intensity

Sample can be taken automatically by using machine or manually by hand using tiers or dynamic spear. The approved sampling intensity for the respective lot sizes is as stated below:

Seed in containers

1. If the containers are up to 5, then a sample has to be taken from each container. Not less than five primary samples are expected in each case.
2. If the containers are more than 5 i.e. from 6 to 30, sample at least one in every three containers but never less than five primary samples.

Seed in bulk

1. If the bulk is less than 50kg, at least three primary samples should be taken.
2. Above 50 to 500kg, at least five primary samples.
3. Above 500 to 3,000kg, one primary sample should be taken for each 300kg but not less than five primary samples.
4. Above 3,000kg to 20,000kg, one primary should be taken for each 500kg but not less than 10 primary samples.

3.2.3 Receiving and Registration of Submitted Sample

The submitted sample for seed testing must be received at the official Seed Testing Laboratory (STL) in a container to prevent fraud. Samples for moisture content test must be put in a moisture proof container. On receipt of samples at the STL, the following procedures must be followed to differentiate samples from farmers and prevent favouratism.

1. Receipt and registration of seed samples: the samples received in the laboratory should be entered in a pre-printed register or forms and assigned a test or lot number to be used in all the analysis. The form should contain the following information:
   - Sender's name
   - Sender's address
   - Species
   - Variety
   - Origin of seed
   - Class of seed
   - Lot number
   - Quantity of seed sampled
   - Number of bags
   - Kind of test requested
   - Place and date of sampling
   - Treated or not
   - Name and signature of sampler

For speedy operation, it would be desirable to simultaneously prepare separate seed analysis cards and envelopes for working samples. The lot number would invariably be written on each card and the envelope. These are passed on to the person responsible for preparation of the working

samples. The entire work should be so arranged that it is completed the same day.

2. Working samples: After entering the sample, the next step is to prepare the working samples to the required sizes immediately so that whatever test is required would be completed on time.
3. Conduct of test: Every effort should be made to complete all tests as quickly as possible. These should be carried out strictly as per the procedures for conduct of the test.
4. Reporting of results: after the tests have been completed, the results are reported on a printed form known as 'seed analysis certificate'. One of the common complaints against seed testing laboratories is length of time taken to complete one analysis. It is therefore important to ensure that there are no undue delays. The result of seed samples received from seed inspectors under provisions of the seed act should be communicated within 21 days but not later than 31 days.
5. Storage of guard samples: The submitted samples received by the seed testing laboratory, on which reports are issued should be stored after analysis for one year from the date of issue of report. Storage should be under conditions that would not alter or change the quality of the samples.

3.2.4 Sections in a Seed Laboratory

A standard Seed Testing Laboratory has four distinct sections which mandatory tests are usually conducted for labeling purposes: These are:

1. Section for seed purity testing: Purity analysis of seeds is considered under two facets viz (a) testing of cleanliness of seed lot and (b) testing the genuineness of the cultivar
2. Section for moisture testing
3. Section for viability, germination and vigour testing
4. Section for seed health testing: This section tests for crop diseases and field establishment of seedlings.

SELF-ASSESSTMENT EXERCISE

Describe How are seed samples registered at the Seed Testing Laboratory?

4.0 CONCLUSION

Seed testing is a tool designed to minimise to the least possible degree, the risks involved in planting seeds of poor quality. Seed farmers must therefore have their seed tested before customers would have confidence in patronising their produce.

5.0 SUMMARY

In order to minimise losses due to planting low quality seeds, ISTA has designed standards for seed testing which every Seed Testing Laboratory has to comply. Once these standards are maintained, the end users have confidence in what they are buying and the producers also either loose or have a favourable patronage depending on the production effort they invested.

6.0 TUTOR-MARKED ASSIGNMENT

1. What does ISTA stand for?
2 Define the following terms, seed lot, primary sample, composite sample, working sample, submitted sample and sealed sample.
3. Describe the approved sampling intensity for seed lots in containers and bulk seeds.

7.0 REFERENCES/FURTHER READING

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MODULE 6 SEED STORAGE

UNIT 1 STAGES OF SEED STORAGE

CONTENTS

1.0 INTRODUCTION

After harvest, seed has a transition period, which is from time of harvest to the time of planting or consumption. This transition period is referred to as time of storage. Storage could be long or short depending upon the circumstances and the use to which the seed is intended. Whatever the intended usage may be, seed storage is a very important period that can lead to either safety or deterioration of seed. Care must be taken to store seeds according to prescribed guidelines.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- state the different stages at which seeds are stored
- identify the factors affecting seed longevity in storage.

3.0 MAIN CONTENT

3.1 Storage Life of Seed

The entire storage life of seed has been conveniently divided into the following stages:

1. Storage of seed plant in the field: Once seed has attained physiological maturity and about to be harvested on the field, any delay in harvest means that the seed has been stored on the field. The seed is therefore exposed to adverse weather conditions and attack by fungi, insects, birds and rodents.
2. From period of harvest until processing: This transition period between harvest and processing may take long or short period depending on individual crop. This storage period is referred to as 'after-ripening. While it is desirous for some crops to attain full maturity, it may be disastrous for some crops if it goes beyond certain limits. Some farmers leave the seed stored in the open on the farm while others store seed in a warehouse pending threshing.
3. Storage in warehouses: This is the storage period that follows after seed has been processed and packaged. This is considered to be the longest period of storage because seed stay in this state until they are distributed for either planting or further processing into food, feed or any other industrial use in case of grain.
4. Storage while in transit: After storage in warehouse, seed is moved either to the farm directly for distribution to farmers, or to the industry in case of grain. Seed is therefore stored during this transit period in rail wagons, trucks, carts, rail sheds and boots of cars.
5. Storage in retail shops: Seed meant to be distributed to farmers sometimes get into market retail shops.
6. Storage on the user's farm: sometimes, not the total stock of seed conveyed to the farm can be planted same day. The rest seed can be stored in a farm storehouse pending when it will be put to use.

3.2 Factors Affecting Seed Longevity in Storage

Seed longevity refers to the period during which a seed remains viable and can germinate when exposed to favourable conditions until when viability is lost. This period varies widely in different crops. Some crops are short-lived and therefore have short storage life while some may remain viable for decades. Seed ageing and loss of germination during storage cannot be stopped altogether but it can be appreciably reduced by providing good storage conditions. Factors that affect the life span of seed during storage include:

1. Kind/variety of the seed: The seed of some varieties are naturally short-lived while other may have longer shelf life in storage due to differences in their genetic constitution.
2. Initial seed quality: Clean undeteriorated seed with high vigour store longer than seed which had started deteriorating due to weathering damage, mechanical injuries, wrinkled or other causes. It is therefore advisable that only high quality seed should be stored.

3. Moisture content: High seed moisture content greatly accelerates seed deterioration and its life span. Recommended moisture contents for safe seeds should be adhered to.
4. Relative humidity and temperature: Temperature and humidity are the two most important factors affecting seed quality in storage. The higher the temperature of the seed, the lower the life span. Also the higher the humidity of the seed the lower the life span.
5. Rodents and birds: All openings on the storage structure should be sealed or screened against birds, rats and other rodents. Adequate ventilation should be provided since they are constant source of seed loss.
6. Storage in transit, at the retailer's store and user's farm: All effort about construction of a befitting warehouse would be lost if in the end seed would lose its viability either while in transit, retailer's store or on the user's farm house. Adequate storage precautions at these points are therefore very necessary.

3.3 Hygroscopic Nature of Seed

Seed is hygroscopic in nature. After seed has been harvested, it has to be cleaned and dried to safe moisture content before storage. Drying occurs when moisture is evaporated from the seed surface into the surrounding air. The process can be explained in terms of vapour pressure differences between the moisture in the seed and that in the air around the seed. Vapour pressure is directly dependent on concentration of water molecules. When high moisture seed is exposed to low-humidity air, a vapour pressure gradient is created in the seed and evaporation occurs. Evaporation will continue in the direction of the vapour pressure gradient until the vapour pressure of the two systems are equalised. Once equilibrium is reached, there is no further moisture exchange unless the moist air removed from the seed is replaced by dry air. Moisture movement will also be reversed; if dry seed is placed in high humidity conditions, the seed will absorb moisture from the air. This will also continue until an equilibrium is reached thus exposing the seed to deterioration due to the hygroscopic nature of the seed.

A seed storage structure should therefore be constructed in such a way that it would provide a proof against prevailing weather conditions.

SELF-ASSESSTMENT EXERCISE

1. Describe the stages of seed storage.
2. What factors affect seed longevity in storage?
3. Explain the hygroscopic nature of seed as it affects storage.

4.0 CONCLUSION

The ability of seed to maintain viability even after a long duration of storage has so many advantages. At all stages of storage therefore, adequate precautionary measures should be taken to ensure that deterioration is highly minimised.

5.0 SUMMARY

Seed storage at all stages from harvest point to warehouse and end user has to be considered as a very important function. To ensure seed longevity in storage, adequate measures during drying, processing, transportation and construction of a conducive storage structure should be undertaken.

6.0 TUTOR-MARKED ASSIGNMENT

1. Describe the stages of seed storage.
2. What factors affect seed longevity in storage?
3. Explain the hygroscopic nature of seed as it affects storage.

7.0 REFERENCE/FURTHER READING

Agrawal, R. L. (2005). *Seed Technology* (2nd ed.). New Delhi: Oxford & IBH Publishing Co. PVT Ltd.

UNIT 2 GENERAL PRINCIPLES OF SEED STORAGE

CONTENTS

1.0 INTRODUCTION

In the last unit, we discussed the various stages of storage and highlighted the factors that can influences early deterioration as seed is stored through this various stages. There are however, laid down principles that if followed would minimise the influence of those factors. We shall therefore discuss the principles necessary for good storage in this unit.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- identify the general principles of seed storage
- discuss the different types of storage requirements.

3.0 MAIN CONTENT

3.1 General Principles of Seed Storage

The general principles that are necessary for good storage are:

1. Seed storage should be in dry and cool conditions
2. Seed storage should have effective pest control facilities.
3. There should be proper sanitation in seed stores.
4. Seed should be dried to safe moisture limits before being kept in the store.
5. Only well cleaned, treated seed of high germination and vigour should be stored.
6. It is necessary to determine seed storage needs in terms of length of storage, and prevailing climate of the area during storage period well ahead before commencement of constructing seed storage

Regions with favorable storing conditions (less humidity and dry air) require less sophisticated building materials compared to areas with high humidity.

As the requirement become more exacting, the cost of storage facilities per unit of seed stored increases.

3.2 Types of Storage Requirements

The type of storage requirements refers to the intended need to which the seed is stored to satisfy, the need determines the length of storage and is classified into four types thus:

1. Storage of commercial seed: About 75 to 80% of total seed stored is usually distributed to farmers. The storage period ranges from a few days to eight or nine months. If the storage period is so short and no rain is anticipated the seed could be stored in the open. If storage of commercial seed would take long, it should be stored in a storage structure constructed with regards to the principles state above.
2. Storage of carry-over seed: carry over seed: Carry over seed refers to seed that is stored through one growing season to the next planting time. About 20 to 25% of seed is expected to stay that long. The storage period is between one year to one and half years. With this type of storage, it would be advisable to provide some insulation to the storage structure to keep it as cool as possible. The seed should also be packed in moisture proof bags.
3. Foundation seed stocks: It is always advisable that foundation seed stock should be reserved and stored for several years. This reserve will help to resuscitate the variety in case there is a mix up during multiplication. This type of storage demands better storage facilities than what is needed for commercial or carry-over seed. The quantity of seeds involved is not large (Between 20 - 25%) the store room can be a small room within a large warehouse. The walls have to be constructed with moisture proof metal or polyethylene bags at least 7mm thick and fitted with a dehumidifier to maintain the relative humidity not beyond 45% and a temperature of about 20^{o}C. In hot environments, air conditioner is necessary.
4. Germ-plasm seed: Germ-plasm seed is required to be stored for many years even longer than foundation stock. Basic requirements are cold temperatures that are economically possible and seed moistures between 20 to 25% relative humidity. Germ-plasm seed must be dried to the proper moisture level.

3.3 Construction Features for Good Seed Warehouse

1. A good seed warehouse should have no windows and have only one door constructed of metal which can be sealed and properly locked.
2. The foundation for the warehouse should be made of stone or concrete and should be at least 90cm above the ground level. The material used for walls may be stone, concrete, brick, metal or wood.
3. The door must be paved and any cracks that may develop must be repaired
4. Floor, walls and ceiling of the storage should not consist of holes that can habour insects. All cracks around openings, e.g. electric conduits, ventilation openings and doors should be thoroughly sealed and or screened against birds and insects.

SELF-ASSESSTMENT EXERCISE

1. What are the general principles of storage?
2. Explain the four different types of storage requirement.
3. What are the constructional features for a good seed warehouse?

4.0 CONCLUSION

Seed storage is as important as production. This is because all effort expended to produce would be a waste if the seed deteriorates during storage and the intended use is not achieved. Efforts must therefore be made at every stage of storage to comply with recommended storage practices.

5.0 SUMMARY

After harvest, seed must be kept in some places pending when it would be processed. Thereafter, seed must again be stored prior to distribution to farmers or even in the farm store house before use. The general principles of storage are therefore designed to maintain or preserve the physiological quality of seed by minimising their rate of deterioration. Storage room must be clean and adapted to the needs. For longer storage periods, special conditions are usually needed and the store must be provided with temperature and humidity control equipment.

6.0 TUTOR-MARKED ASSIGNMENT

1. What are the general principles of storage?
2. Explain the four different types of storage requirement.
3. What are the constructional features for a good seed warehouse?

7.0 REFERENCE/FURTHER READING

Agrawal, R. L. (2005). *Seed Technology* (2nd ed.). New Delhi: Oxford & IBH Publishing Co. PVT Ltd.

MODULE 7 SEED MARKETING AND DISTRIBUTION

UNIT 1 PRINCIPLES AND OBJECTIVES

CONTENTS

1.0 INTRODUCTION

Marketing is a set of activities that facilitate economic exchange of goods and services in order to satisfy human needs. The marketing function plays a very important role in the survival of a business organisation because it is through marketing that the resources that finance the utilities of the organisation are generated. It is also through marketing that the products of the organisation get to consumers. Marketing therefore determines the survival or the very existence of the organisation.

The main objective of seed marketing is to supply enough quantity of high quality superior improved seed to farmers at an affordable price as at when needed and to secure a reasonable profit to the producer. There are various activities, which stimulate the marketing cardinal objective of satisfying consumers need profitably. These include marketing research; product creation, development and positioning; Advertisement and promotions; Sales; Distribution, Pricing and services and service follow-up.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain what seed marketing is and state its major objective
- outline the importance of marketing
- identify and explain the principles of marketing.

3.0 MAIN CONTENT

3.1 Importance of Marketing

Marketing helps to enhance value and benefits to customers. Several benefits are derivable from the performance of the marketing function as outlined below:

1. Marketing helps to improve the quality of goods and services offered, as every competing marketer tries to offer better products, price, place and promotion in order to have more sales. This leads to improvement in the quality and quantity of goods and services offered in the society.
2. The standard of living of the society is improved as a variety assortment of goods and services are made available to the customer thereby allowing the customer a wide range of choice to select. It assists in ensuring that the desired good and services are made available at the convenience of the customer so that needs are adequately satisfied.
3. Job opportunities are generated and maintained through the performance of the marketing function. A large percentage of the labour force is engaged in marketing activities such as retailing, wholesaling, communication, transportation, insurance, banking and even marketing activities of manufacturing organisations.

3.2 Principles of Marketing

The principles of marketing are referred to as marketing variables or marketing mix. They are further named based on their composition as the FOUR "Ps" of marketing. These are product, place, price and promotion.

1. Product: Product is anything that satisfies human needs. A product can be goods (tangible) and services (intangible). A product may also include supportive elements like packaging, colour, branding, post purchase services and other attributes that are cherished by customers. Also associated with product is labeling. Labels provide information and instruction on the product, its usage and expiry date. In the seed industry, product is the superior high quality seed produced and the accompanying technical information on the production practices for its effective use.

2. Place: This is also referred to as distribution and it involve the movement of products to the point where it is demanded. It bridges the gap of space and time between production and demand. In distributing products, several channels of distribution are available for the marketers to select. The key to success in seed marketing is the establishment of an effective channel of distribution. The

choice of the type of channel to use should be determined by some or all of the following factors:

(a) Market coverage: The intended number of farmers the seed is expected to be distributed to, will determine the type of channel. A channel with so many intermediaries' increases coverage while that with small intermediaries reduces coverage.

(b) Perishable nature of the seed: Seed which require exotic storage facilities to maintain their shelf life do not need a long chain of intermediaries while those that can store well under normal atmospheric conditions could be distributed through long channels without risk.

(c) Cost: The shorter the channel, the higher the cost of distribution and vice-versa. It should be noted however that when there is a high distribution cost, such cost is usually transferred to the consumer and where there is high competition, the consumer chooses to patronise the cheapest offer.

3. Price: Price is the sacrifice made by buyers and sellers so as to satisfy needs. The customer sacrifices money while the seller sacrifices the products so that the needs of the seller (profit) and that of the customer (wants) can be satisfied. Fixing of prices is usually based on certain motives the price is meant to achieve. The price fixed on a product could be to achieve all or any of the following objectives:

(a) Profit maximisation: The aim is to achieve maximum current profit. It involves fixing a high price so as to minimise losses from a new product that is likely to be a failure in the market.

(b) Market share: The aim is to sell to a large number of consumers. This involves fixing a low price so as to bring about a high demand for the product. Economics of scale advantage will result to low cost of production thereby resulting to the desired profit in the long run.

(c) Marketing skimming: the aim is to serve those customers or buyers that are ready and willing to pay a higher price than others in the aggregate market. This entails fixing a high price.

(d) Target profit: The price is fixed so as to enable the firm achieve a certain rate of return on investment which perhaps is considered satisfactory when compared to the level of investment and risk of the firm.

(e) Gain promotional points: This involves pricing a popular product at a low price in order to attract buyers who eventually may buy other products of the same company. The low price of one product is used to promote sale of another product that is perhaps complementary.

Producers are advised that pricing policies should consider the possible reactions of the various parties that will be affected by the pricing decisions of the producer of company. The parties are the distributors, competitors, suppliers, government, salesmen and buyers.

4. Promotion: Promotion involves all activities aimed at persuading and communicating in order to facilitate the sale of products or acceptance of ideas. The following are promotional activities that can be used in combination to persuade and communicate in order to enhance sales:

(a) Advertising: Advertising is a paid non-personal presentation and promotion of ideas and products by an identified sponsor. It can take various forms and uses. The various advertising medium are newspapers, radio, television, billboards, catalogue, internet, posters etc. advertising covers a large portion of the marketer at a low cost.

(b) Personal selling: This involves contact between the seller and buyers so as to stimulate demand and facilitate sales. Personal selling is limited to the number of contact that can be made though it has greater impact on customers. The response is instantaneous in personal selling (buy or not buy response). Personal selling contact can be through the internet, telephone and personal presentation.

(c) Publicity: This is an independent non-paid presentation and promotion of ideas or product by a media house in the form of news, ideas, editorials, review, etc. potential customers and customers tend to believe publicity as it is not paid for by a sponsor. However, there is little control over publicity by marketers.

(d) Sale promotion: This is a seller-initiated effort to stimulate and increase sales through sales promotion tools like coupons, demonstrations premiums, contests and sweepstakes. It is used to attract new customers and to increase the purchases of existing customers. It could also serve to deplete inventories that have been unsold for a long time.

SELF-ASSESSTMENT EXERCISE

1. What is marketing? What important roles does the marketing function play to the producer and consumers?
2. Discuss how “place” as a marketing mix can be manipulated to facilitate the seed marketing function.

4.0 CONCLUSION

The satisfaction of needs of customers is critical to the survival of every organisation. Satisfied customers repeat purchases or patronage and

inform others. Dissatisfied customers create marketing problems for organisations. The marketing function assists organisations to effectively provide products that would satisfy the needs and aspirations of their customers and as such achieve organisational goals.

5.0 SUMMARY

Marketing is very important because it satisfies both the producer and the consumer. They both make sacrifices to have their needs satisfied. Before a market can satisfy its purpose, a careful study of the marketing principles must be done. This would enable the marketers know what technique they should apply in whatever situation they are placed in order to achieve their set goal.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is marketing? What important roles does the marketing function play to the producer and consumers?
2. Discuss how “place” as a marketing mix can be manipulated to facilitate the seed marketing function.

7.0 REFERENCE/FURTHER READING

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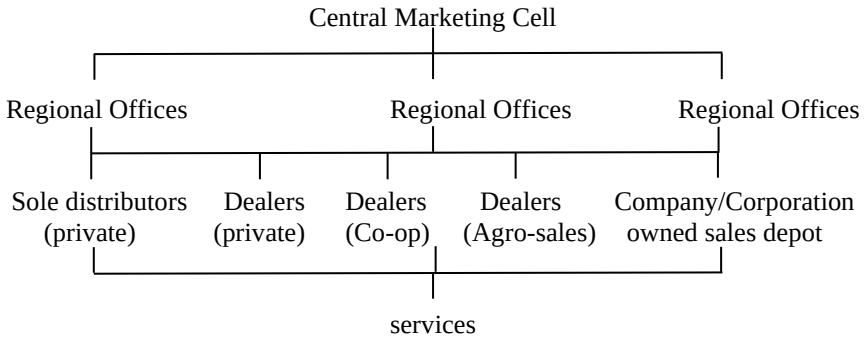
UNIT 2 MARKETING ORGANISATION AND MANAGEMENT

CONTENTS

1.0 INTRODUCTION

The success or failure of every set up is determined by the way it is organised and run. In like manner, seed marketing organisation plays a vital role in the overall running of the business. The organisation sets up checks and balances and ensures that the right people are placed to handle their correct responsibilities.

An efficient market organisation usually has a central marketing cell which governs the whole marketing operations. Next to the central marketing cell are regional offices which get their supply from the central cell and pass it over to the retail units for onward distribution to the farmers or end users. The organogram is as shown below.



Under this type of arrangement, the central marketing cell is responsible for planning, appointment of dealers/distributors, seed movement, marketing intelligence, research, pricing, promotional activities, financing and record keeping.

The regional offices are responsible for seed supply and promotional materials to dealers/distributors, training of seed dealers, expansion into new market areas, publicity and execution of promotional programmes.

The dealers and distributors are the last but most important link in the chain of seed marketing because they are the ones that handle the main marketing practices.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- draw a simple organogram of seed marketing organisation
- explain the marketing practices of a seed enterprise.

3.0 MAIN CONTENT

3.1 Marketing Practices of Seed Enterprise

In the marketing chain, it is the dealers or distributors who actually are the most important because they are involved in the actual conduct of the marketing practice. They must therefore have the following qualities:

1. Ethical dealings: They must possess good professional standards of conduct.
2. Sell quality seed only: it is difficult to differentiate local varieties of certain seed from improved varieties by visual characteristics of the seed alone. The dealer should not therefore cheat by supplying local seed to customers who has paid for improved seed.
3. They must have proper storage facilities to avoid deterioration of seed while in their custody.
4. Dealers must maintain attractive shops that would attract the attention of consumers.
5. Dealers should make wise use of publicity.
6. They must have adequate knowledge of the product they are distributing and know their competitors.

SELF-ASSESSTMENT EXERCISE

1. Draw a simple organogram of a seed organisation and give a brief explanation of how the government shown on the organogram is run.
2. What qualities and conducts must a good seed retailer possess?

4.0 CONCLUSION

Close co-ordination should be maintained among the managers of the various operations in the seed industry i.e. production, processing and marketing so that programmers in each section can be oriented to provide rapid feedback from the customers on seed quality, quantity, packaging

and other important areas. This would enable the organisation to make necessary adjustments where needed for the overall good of the industry.

5.0 SUMMARY

If a seed organisation is planned as shown in the organogram, every designated office executes her functions as planned, the marketing function will operate successfully.

6.0 TUTOR-MARKED ASSIGNMENT

1. Draw a simple organogram of a seed organisation and give a brief explanation of how the government shown on the organogram is run.
2. What qualities and conducts must a good seed retailer possess?

7.0 REFERENCE/FURTHER READING

Agrawal, R. L. (2005). *Seed Technology* (2nd ed.). New Delhi: Oxford & IBH Publishing Co. PVT Ltd.