

**REPORT OF FAO CONSULTANT  
ON  
VEGETABLE SEED CERTIFICATION**

**VEGETABLE SEED PRODUCTION PROJECT, NEPAL  
GCP/NEP/040/SWI**

REPORT BY:

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### SUMMARY OF MAIN RECOMMENDATIONS:

1. Information from field trials and other relevant data of the eight vegetable varieties (see Table 2, page 12) should be submitted to the Variety Release Committee.
2. A vegetable seed certification Scheme should be put into operation in Nepal. The above varieties, if approved for release by the variety Release Committee should enter the scheme from 1987/88.

3. In the first year of the scheme, certification produces will concentrate on Foundation Seed. Thereafter both Foundation and certified Seed will be subject to certification procedures.
4. The production of nucleus seed should remain the responsibility of the organization maintaining the variety.
5. The control of standards for varieties not in the vegetable seed certification Scheme should be at Foundation and Improved Seed categories. The improved seed Category is the equivalent of Certified Seed, but subject to “Seed Crop Approval”, not “Seed Certification”.
6. The same field and laboratory standards should apply for ‘certified’ and ‘improved’ seed categories.
7. Eight further vegetable varieties are recommended for consideration for entry into the Seed Certification Scheme from 1987/88 onwards.
8. Specific Field Inspection Standards are recommended for the vegetable seed crops produced in Nepal.
9. Specific working Laboratory Standards are recommended for the vegetable seed crops produced in Nepal.
10. Tolerance for the laboratory standards should be received and amended after one year from implementation of the scheme in order to provide for the minimum standards desired and achievable in Nepal.
11. The introduction of field Plot testing facilities, to be organised jointly by STIP and the Vegetable Development Division is recommended.
12. Recommendations are made for regular National training in Seed Production and Seed Certification.  
Out of country Training has been identified in botanical documentation of vegetable varieties and Vegetable seed Certification Procedure.

## **INTRODUCTION:**

### Background:

The Vegetable Seed Production Project (GCP/NEP/040/SWI) commenced in 1981 with the overall objectives of increasing the income of small farmers and to improve the nutrition of the Nepalese people by increasing the production and consumption of vegetables. The project is closely associated with the vegetable development division.

The detailed objective within Phase II of the project’s programme which commenced in 1984 include: handling, marketing and quality control of vegetable seeds, assist in developing proposals for variety release, to take up a maintenance programme for newly identified varieties, to develop a

seed quality programme by applying working standards, to develop official vegetable seed standards for Nepal and to initiate seed certification in important vegetable crops.

#### Terms of reference:

With this background the Project requested FAO vegetable seed consultant Mr. Raymond A.T. George to visit Nepal. The Terms of Reference for this consultancy are given in Appendix I.

#### Dates of Consultancy:

The Consultant was in Nepal from 30 December 1986 until 30 January 1987 inclusive. A detailed Itinerary and list of contacts made during this period is provided in Appendix II.

#### Background of Mission:

The first seed certification programme commenced in Nepal for wheat in 1977/78 season and other agricultural seed crops including rice and maize have since been included in the scheme. However, until the present time no vegetable varieties have been included.

The inclusion of some vegetable varieties in a vegetable seed certification scheme is considered by the relevant Government agencies to be necessary in order to maintain the crop and varietal purity of the material produced by the vegetable development division (in association with the vegetable seed production project). This is believed to be especially necessary for ensuring a satisfactory level of purity in the final stage of multiplication by contracting farmers. The introduction of a certification scheme for vegetables is also requested with the object of providing a guarantee to farmers who purchase and use this seed that the material corresponds with the labelling and reaches a minimum required level of genetical purity, potential germination and within a stated tolerance of freedom from other material, (i.e. analytical purity).

A seed act (“the Seed Act 2043”) has been drafted for Nepal and although not yet passed by His Majesty’s Government it is envisaged that it will become a part of the Legislation. The proposed (draft) Seed Act allows for, and take into account, the provision of a seed certification scheme in any Agriculture crop, with the definition of “Agriculture” meaning cereal, vegetable, fruit and fodder product.

#### Acknowledgements:

The consultant is extremely grateful to all the officials and staff of the Government Agencies with whom cordial, useful and formulative discussions took place within the duration of the mission. Special thanks are due to Mrs. K.L. Rajbhandary and colleagues of the Seed Technology and Improvement Programme, also to Mr. M.N. Pokhrel and staff of the Vegetable Development Division.

A training course on “Seed Quality Control in Vegetables” was organised and implemented during the consultancy and the consultant gratefully acknowledges the contributions and assistance of all participants, both lecturers and trainees. The enthusiasm of the trainees displayed in the lectures, discussions and field trips ensured a successful Training Course.

The assistance of the FAO Representative, Mr.H.R. Stennett and staff in FAO and UNDP, Nepal is gratefully acknowledged.

Finally, the consultant is extremely grateful to the FAO Senior Field Project Officer, Mr.S.S. Rekhi for his detailed attention and assistance throughout the mission and to all FAO Experts and Associate Experts in the Project.

## **MAIN FINDINGS AND CONCLUSIONS:**

### Training Course on “Seed Quality Control in Vegetables”:

In accordance with the consultant’s Terms of Reference (see Appendix I) a training course was organised and implemented from 17 to 23 January 1987 during the mission. The detailed programme, list of topics and lecturers and participants is given Appendix III. The course was attended by 16 trainees.

The main objective of the course was to bring together a range of staff from the different Government Agencies involved with vegetable Seed Production and Seed Quality Control. The discussion periods and field visits served as a forum for identifying and discussing the various problems associated with maintaining and improving vegetable seed quality.

Special emphasis was placed on Field Inspection Standards, including genetical quality, multiplication stages, tolerance, seed health and sampling procedures. A background to the procedures and analyses for which the submitted sample is used were also explained.

The course also included an outline and exploration of the components of a fully integrated seed certification scheme and the possible role of these in a certification scheme for vegetable seed production in Nepal.

As a result of earlier discussions with staff of the National Agencies involved with vegetable seed production and vegetable seed quality control the consultant had identified a need to include sessions on variety classification and an exploration of the concept of “Distinctness, Uniformity and Stability” (D.U.S) testing in association with variety release, maintenance, classification and certification. Therefore, lecture and practical demonstration sessions on these topics were also included in the course programme.

Practical material to demonstrate seed, seedling and young plant characters of Radish (four varieties), Pea (three varieties), cauliflower (three varieties) were specially prepared in advance of the training course.

It was clear that participants became aware during the training periods of the importance of documented botanical and morphological in addition to the economic or agronomic features of specific varieties.

Field visits to multiplication and purification plots at Khumaltar and Sarlahi emphasized the need for attention to detail during variety maintenance. A wide range of vegetable crops was able to be studied during the field sessions with emphasis on temperate vegetable species at Khumaltar and sub-tropical at Sarlahi.

Visits to contract farmers producing vegetable seed crops enabled participants to appreciate the practical problems of the final stages of multiplication and the need for a good relationship between farmer and seed agency.

Throughout the course the relationship between Seed Production Agency and Certification Agency was emphasized and the importance of good seed production practice with the production and multiplication of all seed classes was highlighted.

#### Activities of the Project and Vegetable Development Division:

The Project is currently producing seed of some 41 varieties of vegetable crop species.

Each of these cabbage has been produced from either local land races or imported varieties.

These crops and varieties are listed in table 1 together with the seed yields obtained in 1985-86 season and the achieved yield or estimated for 1986-87 season.

**Table 1:** Vegetable Crops and Varieties under Purification or maintained by Vegetable Development Division, yields for 1985-86 and actual (or estimated) yields for 1986-87.

CROP	VARIETY	YIELD (KG)	
		1985-86	1986-87
Radish	Mino Early	11996	16740
Radish	White Neck	1700	2525
Radish	Pusa Chetki	18	20
Cauliflower	Kathmandu Local	844	956
Cauliflower	Snowball-16	60	60
Cauliflower	Pusa Deepali	-	60
Cabbage	Large Late Drum Head	455	150
Cabbage	Copenhagen Market	-	660
Cabbage	Pride of India	180	510
Broad Leaf Mustard	Khumal Broad Leaf	1565	2315
Broad Leaf Mustard	Marpha Broad Leaf	703	15

Onion	Red Creole	3425	4200
Pea	New Line Perfection	8812	8755
Pea	Arkel	60	470
Pea	Sikkim	-	500
Turnip	Purple Top White Globe	728	815
Carrot	Nantees Forto	129	650
Hot Pepper (Chilli)	Yatsufusa	103	5
Hot Pepper (Chilli)	Jwala	70	65
Tomato	Monprecos	22	14
Tomato	Pusa Ruby	1334	1300
Tomato	Pusa Early Dwarf	-	60
Tomato	Roma	20	10
Brinjal (Eggplant)	Sarlahi Green	5	1573
Brinjal (Eggplant)	Nurki	5	1573
Brinjal (Eggplant)	Pusa Purple Long	-	15
Sweet Pepper	California Wonder	11	46
Okra	Pusa Sawani	3951	5120
Spinach	Local	2041	6810
Cress	Extra Curled Leaf	771	1900
Beans	Kentucky Wonder	1068	1000
Asparagus Bean	Local Long	774	230
Cucumber	Local	413	-
Cucumber	Poinsett	119	770
Watermelon	Sugar Baby	802	10
Bottle Gourd	Pusa Summer	6	650
	Prolific Long		
Sponge Gourd	Pokhara Local	-	-
Sponge Gourd	Pusa Chickni	738	620
Bitter Gourd	Pusa Do Mosami	647	450
Summer Squash	Black Zucchini	10	80
Summer Squash	Grey Zucchini	2	5

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**Activities of the Seed Technology and Improvement Programme (STIP):**

1. **Seed Testing:**

The Seed Technology and Improvement Program (STIP) is actively engaged in the laboratory testing of vegetable seed samples submitted by the Vegetable Development Division and other Government Agencies.

The main involvement with vegetable seed is determining mechanical purity of seed samples, including weed and other crop species. The germination of seed lots is also

determined. The central laboratory and/or its Regional Laboratories would be capable of examining and reporting on the germination, purity, moisture content and 1000 grain weight of submitted vegetable seed samples.

The basic information and capability to implement seed health testing of vegetable seed is not yet documented and further work is necessary in liaison with the plant Pathology Division, to relate field incidence of pathogens with observed infection in submitted seed samples.

Although the central laboratory is capable of determining 1000 grain weights of submitted vegetable seed samples further work is required in liaison with the Vegetable Development Division to relate optimum seed size for satisfactory laboratory performance when testing for germination and/or broken seeds with screen sizes and other relevant factors during final stages of seed processing and upgrading for individual crop species. A system of vegetable lot identification is required.

## 2. Variety Descriptions and Control Plots:

The Seed Technology and Improvement Programme commenced some pilot work on producing botanical descriptions of the following vegetable crops during 1985-86 season:

Cabbage	: Copenhagen Market
Cabbage	: Pride of India
Cauliflower	: Kathmandu Local
Chinese cabbage	: Local
Khol Rabi	: Local
Turnip	: Purple Top White Globe
Radish	: Pyuthane

This work will be continued in the 1986-87 season and it planned to include some varieties of Carrot, Capsicum and possibly Tomato in the botanical studies.

The need to work with material of a high level of genetical purity was emphasized.

Small growing-on plots of some of the above vegetable varieties have been established at STIP, but basic field facilities with adequate irrigation supply are not sufficient. In addition, care must be taken to exclude cross-pollinated flowering vegetable crop species at this location as this will interfere with the isolation requirements of the nearby Vegetable Development Division's field station where variety purification and foundation seed production takes place.

There is a need for further training to strengthen the variety description activity.

## 3. Field Inspections:

Pilot work has started in 1985/86 season to inspect some vegetable seed production plots of Government Agencies involved in seed multiplication.

This pilot study had disclosed the following problems:

1. Lack of suitable botanical descriptions of varieties for verifying variety purity and trueness to type during any future certification work.
2. Present recommended isolation distances not always respected.
3. Seed crops not always grown in a way that adequate and/or efficient crop rouging or inspections can take place.
4. Species purity was not always found to be satisfactory.
5. There is a need for a clear recommendation or field inspection standards.

### Field Visits:

A range of vegetable farms were visited during the consultancy. The farms visited are considered below in two types, production of fresh vegetables for market and production of seed.

#### 1. Production of Fresh Vegetables:

The farms visited demonstrated a high level of vegetables crop intensity and also inter-cropping. In some vegetable plots in the Pokhara region up to five different vegetables were inter-cropped, i.e. cauliflower, cabbage, broad leaf mustard, eggplant and a cucurbit.

Vegetable producers were generally enthusiastic about seed of varieties originating from the Vegetable Development Division although there was evidence in some cases of both insufficient supply and criticism of seed purity. In addition there were some comments that seed was not always available in time for the required sowing season. However, it must be pointed out by the consultant that it was not always clear whether these criticism were directly attributable to seed supplied by Government Agencies or seed supply in general which included imported seed and seed produced by farmers and exchanged among themselves.

Generally, there was evidence that some level of seed certification with introduction of a seed crop approval scheme would be benefit, both to the supplier (i.e. Government Agencies) and consumer (i.e. farmer).

The introduction of seed lot reference numbers would also clearly resolve many of the criticisms of seed quality.

#### 2. Production of Vegetable Seed:

The general agronomic level of seed production seed was satisfactory. There was evidence that the activities of the Vegetable Development Division had made very good progress in the relatively short time that it has been operating.

The following observations were made by the consultant:

- a) Contracts with farmers to produce seed for Government Agencies should include very clear instructions regarding previous cropping, method of crop husbandry for the seed crop (i.e. row spacing and optimum seed crop population), isolation requirements, roguing stages, seed crop inspection stages, noxious weeds to eradicate, important diseases to be controlled (whether or not seed borne), lot number of seed supplied, and a purchasing price which does not tempt the farmer to harvest the crop for fresh market unless the crop is rejected for seed production and any seed crop inspection stage. The basic seed certification standards should also be made known to the contracting farmer.
- b) There was evidence with some transplanted seed crops (e.g. radishes), grown on a root to seed system, that the best, or optimum quality roots for seed production were not always re-planted but sent to market, while some of those planted for seed production should have been rejected for seed production.

The provision for inclusion checking this standard during the relevant inspection of seed certification or seed crop approval scheme would eliminate, or significantly reduce this bad practice.

## ASSESSMENT OF FINDINGS AND RECOMMENDATIONS:

### 1. Establishment of a Vegetable Seed Certification Scheme:

The general opinion of National and FAO experts consulted was that there is a need for the establishment and implementation of a vegetable seed certification scheme.

The consultant is in agreement with this and recommends that such a seed certification scheme should have two main objectives:

- 1) To protect the varieties resulting from the Vegetable Development Division purification and foundation seed programme and which are released by the variety release committee. It would follow that these same varieties would be subjected to a seed certification scheme in their final stage of multiplication. This level of vegetable seed certification for the released varieties would also provide farmers with authentic seed material of the named varieties which were approval by the scheme.

- 2) The varieties which had not been released by the Variety Release Committee but which were included in the Vegetable Development Division's Improved Seed Programme would be subjected to a "Seed Crop Approval" scheme. Seed crops found to be within the required limits for this scheme would be designated 'Improved Seed' of the appropriate varieties.

## 2. Submission of Varieties for Variety Release and entry into Certification Scheme:

In order to achieve the above recommendation the following procedure and prerequisites would have to be set up and specified:

- 1) The name of promising vegetable varieties which have been found to be of economic value and already accepted by farmers as desirable should be submitted to the Member Secretary of the variety release committee.  
This Committee is already established and the procedure for submitting varieties formulated. So far the variety Release Committee has not considered any vegetable varieties and its membership does not include any vegetable crop representation. The two proposed, but unfilled places for representation of vegetable interests should be filled.
- 2) Information from field trials must be prepared for submission to the member Secretary of the variety Release Committee. This information is already available from the Vegetable Development Division. In addition, botanical descriptions must be prepared for each variety submitted for consideration of the variety Release Committee.

Guidelines for botanical descriptions each of the vegetable crops initially proposed for consideration by the committee are given in Appendix IV.

- 3) The varieties listed in Table 2 are recommended for consideration by the Variety Release Committee.

In arriving at this recommendation the following points have been taken into count:

- a) Economic and agronomic value of the material.
- b) Current recognition by farmers as to the value of the proposed varieties
- c) Distinctness, Uniformity and Stability of the material produced by the Vegetable Development Division.
- d) Available quantities of seed stocks of the proposed varieties.
- e) The need to limit the number of varieties entering into the Certification Scheme in the first instance in order to allow for development of infrastructure and training of Certification and seed production staff to deal with the inspection requirements of the new crops.

**Table 2:** Vegetables Varieties Recommended for Submission to the variety Release Committee for inclusion in the Certification Scheme:

CROP	VARIETY	REMARKS
Radish	Mino Early	New variety name to be agreed
Cauliflower	Kathmandu Local	New varietal name to be agreed
Broad Leaf Mustard	Khumal Broad Leaf	
Onion	Red Creole	
Turnip	Purple Top White Globe	
Carrot	Nantees Forto	New varietal name to be 'Nantes'
Tomato	Pusa Ruby	
Bean	Kentucky Wonder	

4) Variety Naming:

Two varieties in Table 2 should be renamed and one name should be modified as indicated in Table 2.

The object of any variety name should be to provide a clear and distinct name that is acceptable to farmers and will be recognized by them and meaningful. In addition, variety names should not be copied from the original material from which the varieties have been purified as in some cases this may cause embarrassment because the name is already recognised, or adopted, by Seed Companies in other countries.

Further caution is recommended in relation to the continued use of names, or prefix to varietal names used by foreign seed companies and also to the multiplication of varietal material protected in other countries by Plant Breeders Rights. Infringement of these points could lead to a bad relationship with some overseas seed organizations and impede any future progress or activities in international seed trade and/or seed quality control at an international level.

The international Code of Nomenclature lists variety names which should be avoided. The main points in the Code relating to vegetables and which should be excluded from variety names are the following:

- a) Arbitrary succession of letters, abbreviations or numbers.
- b) An initial article unless it is the linguistic custom.
- c) Names commencing with an abbreviation.
- d) Names containing a form of address.
- e) Names containing excessively long words or phrases.
- f) Exaggeration of the qualities of the material.
- g) Names which are likely to be attributed to other varieties.
- h) Names which may be confused with existing variety names.
- i) Inclusion of word such as 'Cross' or 'Hybrid'.
- j) Names exceeding three words (where an arbitrary sequence of letters, number or abbreviation is counted as one word.
- k) Latinized names.

3. Varieties to be considered for entry into the Certification Scheme after 1987/88:

As the variety purification programme of the Vegetable Development Division proceeds and additional varieties are seen to be of economic value and observed to be Distinct Uniform and Stable. Further varieties should be added. The varieties listed in Table 3 are considered to be near to the pre-requisites required for release.

**Table 3:** Vegetables varieties currently in the Vegetable Development Division's purification and multiplication programme recommended to be considered for entry in Certification Scheme from 1987//88 season onwards:

CROP	VARIETY	COMMENTS
Cabbage	Copenhagen Market	Subject to further purification and multiplication of seed stocks.
Cabbage	Pride of India	Subject to further purification and multiplication of seed stocks.
Cauliflower	Pusa Deepali	Subject to further and multiplication.
Pea	Arkel	Subject to checking foundation seed level, further purification and multiplication of seed stocks.
Hot pepper (Chilli)	Jwala	Subject to further trials.
Tomato	Roma	Subject to further trials.
Brinjal (Eggplant)	Pusa Purple Long	Subject to further trials and multiplication.
Okra	Pusa Sawani	Subject to further trials.

4. Vegetable Seed Categories (or Classes):

The present categories (classes) of seeds are recognised by the Vegetable Development Division and other agencies involved in vegetable seed production and quality control in Nepal:

- |                                      |   |
|--------------------------------------|---|
| 1) Nucleus seed                      | : Produced by the organization maintaining the variety i.e. Vegetable Development Division. This category is equivalent to Breeder's Seed.  |
| 2) Foundation Seed                   | : This is produced either by the Maintainer (as defined above for Nucleus Seed), or under supervision of the Maintainer. This category is equivalent to Basic Seed in a Certification Programme. (i.e. it is the Basic for production of Certified Seed). |
| 3) Improved Seed<br>not<br><br>would | : This category is equivalent to ' <u>Standard Seed</u> ' when in a Certification Programme or it rejected from a Certification Programme. In a Certification Programme and seen to be within the prescribed tolerances this be <u>Certified Seed</u> .   |

The multiplication rates for some vegetable species (e.g. peas, beans and okra) are relatively low. In such cases there is a need for an additional multiplication stage between Nucleus and Foundation. It is strongly recommended that this additional multiplication stage remains the responsibility and within the control of the Maintainer, and that the stages be referred to as Foundation I and Foundation II respectively.

Further multiplication from either Improved Seed or Certified Seed categories is not recommended.

5. Seed Lot Reference Numbers:

At the present time there is no standard system of allocating a seed lot reference number to each harvested seed lot.

The primary information required in a lot number is:

- 1) Year of Production
- 2) Seed Production Area (i.e. geographical zone or area).
- 3) Registered number of farmer (or seed producer) in the area.
- 4) Location of packaging plant or operation.

Each of the above items can be allocated in a serial number, or code, for example the seed lot allocated the code:

05 A 211 2 1 would indicate:

05 = code for year of production.

A = Geographical area or zone in country where produced.

211 = Registered number of farmer (or producer) in the zone.

2 = Designated code number of the conditioning plant.

1 = Designated code number of packaging site.

The seed lot reference number would remain in the appropriate record book used for recording all seed lots produced, and be used throughout the seed storage distribution system, submitted samples for testing and field plot (growing on) tests.

6. Export of Seed and Reference to Seed Lot:

No vegetable seed should be allowed for export unless it has been certified in the vegetable seed certification programme. This recommendation will safeguard the reputation of the Nepalese seed produced and ensure that a check is kept on the quality of the seed lot exported. In case of any subsequent complaints or problem, the complete history of the seed lot is recorded in addition to the laboratory findings relating to purity and germination of the submitted sample and the field plot test.

The same records will also be available in case of complaint, or investigation, arising from seed distributed within Nepal.

7. Field Inspection Standards:

Working Field Standards:

The proposed working field standards for the inspection of vegetable crop are given in Appendix 5. These standards specify the isolation requirements, tolerances of off-types and tolerances of plants affected by specific diseases in the proposed seed crop at both Foundation and Certified seed levels. In the case of seeds produced under the seed crop Approval Scheme for varieties not in the Certification Scheme; i.e. for the production of 'Improved Seed' the same standards will apply as for 'Certified Seed'.

Two additions to the Proposed Field Standards are recommended:

- 1) That there must be a minimum of 1 year between crops of the same species or sub-species in the case of Brassias and Beta intended for seed production which are sown direct, and this applies also to seed beds or steckling production beds for crops to be transplanted. The same rule will apply when crops for fresh vegetable production are followed by a related seed crop.

The reason for this recommendation is to reduce the incidence of 'volunteer' plants arising from either dormant seed or vegetative material from previous crops. It also reduces the risk of build up of soil borne pests and diseases. Although a rotation of several years would be more beneficial in some cases, this would be unrealistic in the close cropping schedules practiced by some Nepalese farmers.

- 2) Where crops are grown on the root to seed system as in the case of radish, turnip and carrot and with seed crops grown on the bulb to seed system as in the case of onion; the inspection taking place at transplanting or planting out time will include a random

checking to verify trueness to type of the material and that only roots or bulbs which are of the prescribed genetical quality (trueness to type) are used for seed production.

#### Plants affected by Disease:

At the present time, the proposed field standards of tolerances for percentages of plants at inspection found to be infected with the specified disease will apply.

It is intended that at the introduction of the seed certification scheme emphasis will be placed on the incidence of diseased plants in the crop intended for seed production.

When further experience and information is gained on the relationships between incidence in the field and incidence in the sample seed lot obtained from that crop after harvest then a further Laboratory Working Standard will be introduced for individual crop species.

During this time it is anticipated that the seed Laboratory will also develop expertise and document procedures for seed health testing under laboratory conditions.

Officers involved in seed production and officers involved in seed crop inspections should stress to growers the importance of controlling seed borne diseases in the field.

#### Certification Procedures:

The two seed categories, i.e. foundation and Certified will each be inspected at two stages. The responsibility for maintenance of Nucleus Seed should be remain the responsibility of the Maintainer.

The proposed seed class Improved Seed will also be inspected at two stages. Foundation and Certified Seed inspections will be done by STIP Inspectors from the STIP Central Office, with some inspections done by Vegetable Seed Technologists.

In the case of Foundation Seed a minimum of one final inspection will be done for each seed crop by a STIP Central Office Certification Officer, with other inspections for that crop done by a Vegetable Seed Technologists.

For Certified Seed and Improved Seed the inspections will normally be done by a vegetable Seed and Technologist with random checking by a STIP Central Officer Certification Officer.

The above procedure takes into account the present staffing levels and experience of available staff.

### Staffing Level for Seed Crop Inspections:

It is recommended that for self- pollinated vegetable crops one Certification Officer should be available for approximately 50 ha. of seed crop in the field.

The recommendation for Cross- pollinated crops in one Certification Officer should be available for approximately 25 ha of seed crop in the field.

Further training will be required for Vegetable Seed Crop Inspectors. Generally vegetable seed crop inspections will take place in different seasons than the cereal seed crop inspections and the same staff could, in some cases, be used provided that additional training is organised to familiarise staff with the vegetable variety characteristics and characters of true-to-type and off-types at different stages for each crop species.

This training can be done in conjunction with courses arranged for Vegetable Seed Technologists.

### Field Inspection Procedures:

It is recommended that all the field be inspected for all vegetable seed crops at Foundation Level. The reason for emphasizing the inspection at this seed category is to ensure that the best possible genetical quality of Foundation seed is produced. The production of high quality Foundation seed will be minimise problems occurring in subsequent stages of multiplication.

All the field should also be inspected for vegetable seed crops intended for Certified and Improved seed categories. The only exception to this recommendation in field inspection shall be Certified or Improved categories of peas and beans. In these two crops at Certified or Improved Category Inspectors should use a similar sampling procedure as already adopted for cereals, i.e.

1. Calculate total plant population in field.
2. For field of upto 116 ha; make ten quadrates distributed randomly at right angles to the crop rows over the whole field. Each quadrate to be 1m x 20 m. (For fields 16 to 32 ha size 15 quadrates of this size should be observed).

The total number of plants observed in the quadrates will be calculated and the individual plants not conforming to the prescribed field standards will be recorded and the number of off-types and diseased plants calculated as a percentage of the whole field population. Statistical tables for tolerances can be used for this method.

The information obtained will be recorded on the Seed Crop Inspection form already in use for cereal crops.

### Seed Crop Sampling:

The procedure for seed crop sampling already adopted by STIP is in line with the recommendations made the International Seed Testing Association (ISTA). It is recommended that this practice be continued and that the seed sample be drawn from the final harvested seed lot by a seed Technologist who will designate a lot number and dispatch the seed lot immediately to the appropriate STIP Central or Regional Laboratory as indicated in advance by the STIP Central Office.

All required official tests on the seed lot will be done by STIP.

#### Procedure for Sampling Relatively Small Seed Production Fields:

The present procedure recommended and implemented by STIP is as follows:

In cases where several adjacent (neighbouring) farmers each have a relatively small seed production plot the amalgamation of total yields can be allowed provided that all were produced from the same seed stock and all plots were inspected and all plots were found to be in accordance with the minimum requirements as specified in the working Field Standards.

When the above situation arises the submitted sample will be made of separate representative sub-sample in equal proportions, each sub-sample an equal percentage of the final submitted sample. The sub-samples will not be mixed.

#### For example:

It 4 farmers each submit 10 gm sub-sample of radish seed, the total of the submitted sample will equal 40 gm. One arrival at the STIP Laboratory the determinations required to assess the procurement price paid to each farmer will be done on the corresponding sub-sample before bulking the sub-samples.

The consultant fully appreciated the relatively unique situation prevailing in Nepal and accepts the above method of sampling in the case of small farm fields provided that the procedure and pre-requisites described above are followed.

It is also recommended that seed crop records show the original seed lot numbers followed by the new number assigned to the bulked material.

#### Origin of Seed Lot:

It is recommended that at the time of first inspection the inspecting officer should check the authenticity of the seed lot sown by the farmer. At the same time he should check that the actual area sown is (approximately) related to the quantity of the original seed lot, and not in excess.

The recommended field inspection stages for each crop proposed for the certification scheme is given in Appendix VI.

8. Working Laboratory Standards:

The proposed Working Laboratory Standards are given in Appendix VII. The consultant discussed these with the project Leader at STIP and makes the following comments.

Minimum Germination:

This is based on a working standard which is believed to be suitable to the present conditions relating to seed quality in Nepal. However, it is recommended that these should be reviewed at the end of a period of 1 to 2 years from the introduction of the proposed seed production scheme.

The minimum germination is also used to calculate payment to the farmer from whom the seed is procured. It is therefore recommended that the scale of payment should offer an incentive to farmers producing seed lots with germination significantly higher than the minimum germination specified. Alternatively a system must be agreed whereby the minimum germination required for seed purchased from farmers is significantly (possibly + 5%) higher than that specified for sale of seeds.

Minimum Purity:

This standard is also based on a Working Standard which is believed to be suitable to the present conditions. However, it is recommended that the tolerances for each individual crop species be reviewed after the proposed Certification Scheme has been in operation for a minimum of 1 year. The present tolerance (by weight) includes all impurities. It is recommended that specific tolerances be determined from the observations made by STIP laboratories and these provisional figures revised to specify separate tolerances for inert matter and other crop species. An additional tolerance for seeds of noxious weed species should be determined, again after a minimum of 1 years laboratory and field observations following introduction of the proposed seed Certification Scheme.

Addition observations should be made regarding broken, split or otherwise damaged seeds, this is discussed below under the heading of seed size.

Seed Size:

The proposed working Laboratory Standards do not include a standard for seed size. It is generally considered that there is insufficient information at the present time to propose 1000 grain weights for vegetable seed produced in Nepal. However, as discussed earlier in this

report, further joint studies should be made by the Vegetable Development Division and STIP to link maximum effect of screen size and/or other operations during threshing, cleaning and upgrading of seed lots with size of seeds in the final upgraded sample. Similarly, tolerances should be agreed regarding broken, split or otherwise damaged seeds (e.g. in radish, peas and beans) acceptable in the final seed lots.

#### Maximum Moisture Content:

Tentative proposals are made for the maximum percentage moisture content. However, these should be confirmed for each crop species following the collection of appropriate data from seed lots received by STIP. Maximum percentage moisture content tolerances are proposed for specific crops at both unsealed conditions.

#### Field Plot Testing:

Pilot studies were started in field plot testing by STIP in the 1986/87 season with a limited number of vegetable seed stocks.

The adoption of Field Plot Testing is a vital component in a successful Seed Certification Scheme. It is the only check (or control) which can verify the genetical quality (i.e. variety characters) of the seed produced.

Samples of seed should be sown the first appropriate season after the submitted seed sample is received by the STIP laboratory.

The plants are grown in plots of a minimum of 50 or 100 plants and the varietal characters monitored.

The observed characters are compared with the varietal description.

The results of Field Plot Tests can be used to monitor genetical quality of each seed lot and also be used in case of complaints. This is especially valuable for exported seeds.

At the time of variety release a sample of the seed should also have been submitted to STIP who retain it under good storage conditions as a Reference Sample. The performance of Foundation Seed stocks during Field Plot Tests is compared every two to three years with samples from the original Reference Sample. This will provide a check on variety maintenance.

#### Field Plot Testing Facilities:

The present facilities for field plot testing at STIP are not entirely suitable for the field testing of all vegetable species. In addition, in some cross-pollinated species the isolation requirements of the nearby Vegetable Development Division will be infringed.

It is therefore recommended that Field Plot Testing be organised by STIP in close liaison with appropriate stations and approved sites of the Vegetable Development Division.

This work can be done jointly at the present time.

The Field Plots can also be used from time to time for training courses of Seed Crop Inspectors and Vegetable Seed Technologists.

9. Revalidation Procedure:

It is recommended that for certification purposes, the first seed germination test shall be valid for a maximum of 6 months from the date of completion of the test. If certified seed is to be marketed after this duration, then a revalidation test must be done on a sample taken from the main seed lot. The result of the revalidation test must be within the germination tolerance in the Certification Schemes Working Standards.

10. Vegetable Seed Production:

Following the field visits and discussions held with staff of the different agencies involved in seed production and seed quality control the consultant noted the following recommendations:

- 1) There should be three stages of roguing for the seed production of each vegetable variety. During these roguing stages every effort and attention to detail must be made to maintain and where appropriate improve the genetical and other qualities of seed produced.

Reference is made to the FAO Technical Guidelines in Vegetable Seed Production for documentation on roguing stages.

- 2) Officers responsible for seed production must ensure that each and all of the required minimum field standards for each seed category are understood. It is emphasised here that the production of high quality seed is the responsibility of seed producers. The Inspection Service only confirms that the required minimum standard has been to be achieved by the Seed Producer.

11. Training requirements in Relation to Seed Certification:

The following recommendations are made in relation to improving the present level of expertise required for successful Vegetable Seed Certification Programme.

#### In-Country Training:

Regular courses should be organised to familiarise Certification, vegetable Seed Production Technologists and Contracting Farmers with the procedures and standards required for Foundation and Certified seed categories.

At least one course should be organised each year at the beginning of the Certification inspections. The object of this is to familiarise staff with varietal and standards.

#### Out-of Country Training:

#### Botanical Descriptions:

There is a need to provide training in compiling botanical description of vegetable varieties. It is recommended that one staff member from STIP be given a short course (minimum of three months) consisting of instruction and practical work relating to vegetable variety description in a country such as U.K.

#### Vegetable Seed Certification:

There is a need to provide training in the organisation and execution of a vegetable Seed Certification Scheme operating a range of vegetable varieties in a country with infrastructure development from Breeders Seed through to Certified Seed.

## APPENDIX -I

### **GCP/NEP/040/SWI 'Vegetable Seed Production'**

#### TERMS OF REFERENCE

#### Raymond A.T. GEORGE: Consultant - Seed Certification

In collaboration with the chief Technical Adviser, the Consultant will:

- Identify present status of vegetable seed quality in Nepal
- verify the proposed seed and field standards and suggest appropriate amendments

- propose scheme for seed certification for vegetables and identify varieties and crops for which seed certification should be initiated
- propose procedures of field inspection for nucleus, foundation and certified seed production plots
- propose manpower required for vegetable seed certification
- propose germination and purity test and revalidation procedures
- organize at least one training for the field staff of STIP, Vegetable Development Division, Horticulture Farms and AIC staff for field inspection methods
- prepare and submit an end-of-assignment report in an acceptable form.

## **APPENDIX - II**

### **ITINERARY and CONTACTS MADE**

30.12.86 UNDP/FAO Meeting with FAOR Mr. H.R. Stennett, Meeting with Mr.S.S Rekhi. Project Manager Mr.S.S. Rekhi (GCP/NEP/040/SWI): HMG/FAO Vegetable Seed Production Project.

- Visit of Prime Minister, Mr. Marich Man Singh Shrestha and Agriculture  
Minister, Mr. Hari Narayan Rajauriya to Project.
- 31.12.86 Tour of Radish Seed Production Farms, Kathmandu Valley.
- 01.01.87 Visit Agriculture Research Center, Pokhara, meeting and discussions with Dr. R. Raut, Director.
- 02.01.87 Visit Vegetable Procedures, Pokhara District.
- 03.01.87 Visit Vegetable Procedures, Pokhara District.
- 04.01.87 Vegetable Development Division: Meeting with Mr. M.N. Pokhrel and staff of Vegetable Development Division, Khumaltar.
- 05.01.87 - do -
- 06.01.87 - do -
- 07.01.87 Seed Technology and Improvement Programme (STIP): Mrs. K. L. Rajbhandary.
- 08.01.87 STIP: Problems associated with Seed Crop Inspections; Mr. P.R. Neupane. Vegetable Development Division.
- 09.01.87 STIP: Variety Descriptions, Testing and Control Plots; Miss Jwala Bajracharya  
Seed borne diseases and Plant Quarantine: Mrs. Krishna Shrestha  
(Plant Pathologist)  
Seed Health Testing : Mr. Purna Shakya  
(Asst. Seed Technologist)
- 10.01.87
- 11.01.87 National Holiday: Unity Day.
- 12.01.87 Vegetable Development Division.
- 13.01.87 Plant Pathology Division: Mr. Purushotam Amatya (Chief Plant Pathologist)  
Mrs. Krishna Shrestha (Plant Pathologist)  
Mr. Purna Shakya (Asst. Seed Technologist).STIP:  
Tour of laboratory and field facilities.
- 14.01.87 Vegetable Development Division  
Vegetable Development: Field and office discussions with Mrs. K.L. Rajbhandary.
- 15.01.87 UNDP/FAO Finance Office + Visa Office.  
Vegetable Development Division: Preparation of Training materials.
- 16.01.87 Vegetable Development Division, Khumaltar: Preparation of Training materials.
- 17.01.87 Training Course "Seed Quality Control in Vegetables".  
To (See detailed programme and list of participants in Appendix III)
- 23.01.87
- 24.01.87 Meeting with Mission for Evaluation of Seed Improvement and Development Programme:  
- Dr. A.R.H. Shehata (Team Leader) (Director General of Agriculture Research Centre, Cairo)  
- MR. K.P. Wagner (Consultant)  
- Mr.J. Markie (FAO Office of Programme, Budget & Evaluation).

25.01.87 Meeting with Mr.M.N. Pokhrel (Vegetable Development Division)  
Mrs.K.L. Rajbhandary (Seed Technology & Improvement  
Programme)  
Mr. S.S. Rekhi (Project Manager)

26.01.87 Report writing: Kathmandu

27.01.87 Report writing: Kathmandu

28.01.87 Report writing: Kathmandu

29.01.87 Report writing: Kathmandu

30.01.87 Depart Kathmandu for DELHI

31.01.87 Depart Delhi for LONDON

## APPENDIX - III

### TRAINING ON SEED QUALITY CONTROL IN VEGETABLES

Date : 18 January to 22nd January, 1987

Venue : Vegetable Development Division, Khumaltar & Horticulture Farm, Sarlahi.

Special Lecture: Mr. Raymond A.T. George, FAO Consultant.

### PROGRAMME

#### Sunday, 18 January 1987:

- 10:30 : Registration
- : Introduction to Training - Mr.S.S. Rekhi
- 11:30 : Importance of Seed Certification & its components - Mr. George.
- 13:30 : Seed Sampling and Testing - Mrs. K.L. Rajbhandary.
- 14:30 : Vegetable Varieties of Nepal and their identification character - Mr. I.R. Pandey.

#### Monday, 19 January 1987:

- 10:30 : Field Inspection Standards and Procedures of Field verification - Mr. George
- Variety Descriptions - Mr. George.
- 12:00 : Practice in Field Inspection - Mr. George.

#### Tuesday, 20 January 1987:

- 09:00 : Departure for Sarlahi by Road.

#### Wednesday, 21, 1987:

- 08:00 : Seed Conditioning and its Importance in Seed Certification - Mr.L. Pun
- 09:00-12:00 : Inspection of Foundation Seed Crops at Sarlahi Horticulture Farm - Mr. George and Dr. S.S. Chatterjee.
- 14:00-16:00 : Discussion - Mr. George.

#### Thursday, 22 January 1987:

- 08:00 : Inspection of Farmers Seed Plots around Sarlahi - Mr. George and Dr. S.S. Chatterjee
- 14:00-16:00 : Discussion - Mr. George.

Friday, 23 January 1987

08:00 : Departure from Sarlahi to Kathmandu.

LIST OF PARTICIPANTS WHO ATTENDED

“TRAINING ON SEED QUALITY CONTROL IN VEGETABLE”

Duration : 5 days (18 - 22 January 1987)

	<u>Name</u>	<u>Designation</u>	<u>Office</u>
1.	Mr. P.R.Neupane	Asst. Vegetable Development Officer	Seed Technology & Improvement Programme (STIP) Khumaltar
2.	Mr. Hari Bahadur K.C.	Asst. Seed Technologist	- do-
3.	Mr. D.Panjiyar	Asst. Vegetable Development Officer	Vegetable Development Division, Khumaltar
4.	Mr. K.R.Kandel	Agriculture Officer	Agriculture Inputs Corporation, Kathmandu.
5.	Mr. K. Budhathoki	Horticulturist Pokhara	Lumle Agriculture Center,
6.	Mr. R.P. Yadav	Asst. Vegetable Development Officer	Agriculture Inputs Corporation Head Office, Kathmandu.
7.	Mr. D.B. Gharti	Asst. Vegetable Development Officer	Horticulture Station Sarlahi
8.	Mr.K.P.Singh	Asst. Vegetables Development Officer	Horticulture Station Sarlahi
9.	Mr. R.K. Mishra	Asst. Agriculture Botanist	Seed Testing Laboratory Hetauda.
10.	Mr.S.B.Chand	Junior Technician (J.T) Division, Khumaltar.	Vegetable Development
11.	Mr. Gokul K.C.	Asst. Junior Technician (J.T.A.)	Vegetable Development Division, Khumaltar.
12.	Mr. Y.R. Thapa	Supervisor (J.T.)	Pakhribas Agriculture Center, Dhankuta.
13.	Mr. R.P. Rai	Junior Technician (J.T.)	Agriculture Inputs Corporation, Dhankuta.
14.	Mr. D.Chaudhary	Agriculture Officer	Agriculture Inputs Corporation, Sarlahi.
15.	Mr. Y.L. Adhikari	Junior Technician (J.T.)	Seed Testing Lab., Hetauda.



LEAF CHARACTERS : Colour, pose.  
BULB CHARACTERS : Shape  
Colour of outer skin  
Skin quality when ripe  
Flesh colour  
Pungency.

TURNIP:

ECONOMIC CHARACTERS : Season of maturity.  
LEAF CHARACTERS : Shape, extent of leaflets and/or entire leaves.  
Colour and pose.  
ROOT : Shape  
Colour of main root  
Colour of crown.

CARROT:

ROOT TYPE : Season of use.  
FOLIAGE : Amount of foliage, degree of fineness of petiole  
bases, color of petiole bases.  
ROOT : Relative length and width  
Overall shape  
Degree of smoothness  
Colour; colour of shoulder  
Internal root colour.

TOMATO:

ECONOMIC CHARACTERS : Season, earliness, suitability for specific climatic areas.  
PLANT HABIT : Determinate, intermediate or intermediate vigour; general  
plant height.  
LEAF : Extent of cut leaf, leaf colour.  
STEM : Hairiness, colour of seedling  
Colour of mature plant.  
FLOWERS : Degree of yellow pigmentation  
Type of flower truss  
FRUIT : Relative size  
Shape  
External features, (degree of ribbing)  
Degree and intensity of pigmentation  
Number of loci (sections seen in cross-section).

BEANS:

ECONOMIC CHARACTERS	: Season of use and suitability for specific climatic areas.
SEED COLOUR	: Pigmentation and hilum character.
PLANT HABIT	: Dwarf or climbing General habit of bush types and degree of branching.
LEAF	: Shape, texture, colour, pose, relative size of mature leaf
FLOWER	: Colour
POD	: Relative length and shape, character of “break” (i.e.end of pod) Degree of curvature, external pigmentation.

## APPENDIX - V

### Proposed Working Field Standards for Vegetable Crops Seed Production

Crop	Isolation in meters		Off-types %		Plants affected by diseases %		Remarks
	F.	C.	F.	C.	F.	C.	
Pea	50	25	0.1	0.5	0.1	0.2	Designated disease schochyta blight.
Cowpea	50	25	0.1	0.5	0.1	0.2	Designated disease common bean virus.
French Bean	50	25	0.1	0.5	0.1	0.2	Hallow blight, common bean virus.
Cauliflower Cabbage and related crops See Footnote 1	1600	1000	0.1	0.5	0.1	0.5	Black leg and black rot and leaf spot. Plant affected by phyllody.
Chinese Cabbage See Footnote 2	1600	1000	0.1	0.5	0.1	0.5	Phyllody - it is not seed borne, roughing necessary to check spread isolation required from Turnip.
Swiss chard	1600	1000	0.1	0.2	0.1	0.2	Beet yellow. Observe isolation from Red beet, Sugar beet and Beet spinach.
Spinach	1600	1000	0.1	0.2	-	-	
Carrot	1600	1000	0.1	0.2	-	-	
Broad Leaf Mustard	1600	1000	0.1	0.5	-	-	
Onion	1600	1000	0.2	0.5	0.2	0.5	Yellow dwarf disease only in bulb crop.
Pepper (within types) between sweet & hot pepper types	500 1000	400 800	400	0.1	0.2	0.1	0.5 Designated disease is anthracnose, isolation required between hot and sweet pepper.
Okra	500	400	0.1	0.2	-	-	
Tomato	50	25	0.1	0.5	0.1	0.5	TMV virus.
Melons							

Squash, cucumber	16001000	0.1	0.2	0.1	0.2	Designated means in mmk only mosaic virus	
Bottlegourd							
Bittergourd							
		Root colour:					
Radish	16001000	0.1	0.5	-	-		
<u>See Footnote 4</u>		Root shape:					
Turnip	16001000	0.3	0.5	-	-		
<u>See Footnotes 2 and 4</u>							
Eggplant	500 400	0.1	0.2	0.1	0.2	Phomopsis blight.	
Cress	16001000	0.1	0.1	-	-		

F = Foundation Seed

C = Certified Seed/Improved Seed.

Footnotes:

1. Cauliflower, cabbage and related crops also includes Kohl Rabi, Brussels Sprouts, broccoli (green sprouting and other forms of sprouting broccoli).
2. The minimum isolation distances specified each for Chinese cabbage and turnip will also apply for minimum distances between Chinese cabbage and turnip.
3. The minimum isolation distances specified for Swiss chard also applies between Swiss chard and any other species or sub-species of Beta vulgaris i.e. red beet (beet rot), sugar beet fodder beet and between each of these crops.
4. The tolerances for Root colour in Radish and Turnip are 0.1 (Foundation) and 0.5 (Certified Seed). The tolerances for root shape for Radish and Turnip are 0.3 (Foundation) and 0.5 (Certified Seed)

## **APPENDIX - VI**

### **Recommended Inspection Stages for Crop Species Entering the Vegetable Seed Certification Scheme:**

<b>CROP</b>	<b>FIRST INSPECTION</b>	<b>SECOND INSPECTION</b>
Radish	When establish plants are in green leaf stage.	At or immediately after planting of selected roots.
Cauliflower	After planting out, and crop establish, but before curds seen.	When the particular variety is curding.
Broad Leaf Mustard	After planting out, and cop established.	At start of flowering.
Onion	When established plants are in green leaf stage and showing foliage characters and habit.	At, or immediately after planting of mother bulbs.
Turnip	When established plants are in green leaf stage.	At, or immediately after planting selected roots.
Carrot	When established plants are in green leaf stage.	At, or immediately after planting selected roots.
Tomato	When young plants are established, before flowers open.	When first fruits ripen.
Beans	When crop is established, but before flowering.	When first flower are showing but before pods formed.

## **APPENDIX - VII**

### **Proposed working Seed Standards for Vegetable Seeds in Nepal**

S. No	Crop	Minimum germination %	Minimum Purity % (by weight)	Max. Moisture Content % for Unsealed Packing	Max. Moisture Content % Sealed Packing
1.	Bean Broad	75	98	10.0	9.0
2.	Bean French, Pole and dwarf	75	98	9.0	8.0
3.	Beet Spinach	70	96	8.0	7.0
4.	Beet-chard (Swiss chard)	70	96	8.0	7.0
5.	Beet root	70	98	8.0	7.0
6.	Broccoli	75	97	7.0	6.0
7.	Brussel Spr.	75	97	7.0	6.0
8.	Broad Leaf Mustard	75	98	7.0	6.0
9.	Brinjal	70	98	8.0	6.0
10.	Cowpea	75	98	9.0	8.0
11.	Cabbage	75	97	7.0	6.0

12.	Carrot	65	95	8.0	7.0
13.	Cauliflower	70	97	7.0	6.0
14.	Capsicum & Chillies	60	97	8.0	6.0
15.	Cucumber	75	98	7.0	6.0
16.	Cress	60	97	7.0	6.0
17.	Kohl Rabi	75	97	7.0	6.0
18.	Lettuce	70	98	8.0	6.0
19.	Squash	70	98	7.0	6.0
20.	Melon Water & Musk	70	98	7.0	6.0
21.	Onion	70	97	8.0	6.0
22.	Pea	80	98	10.0	9.0
23.	Radish	75	98	8.0	6.0
24.	Spinach	65	97	8.0	7.0
25.	Tomato	75	97	8.0	6.0
26.	Turnip	75	98	7.0	6.0
27.	Gourds (Bitter, Bottle, Sponge, Snake)	60	99	7.0	6.0