

Best Management Practices (BMP) of Onion

FACTSHEET

Intended Audience

This document is prepared for field level extension workers, agricultural cooperative and agro-vet leaderships and farmers to guide them on best management practices (BMP) of onion cultivation to achieve higher yields and better net profit while maintaining and promoting soil fertility.

BMPs refers to the right and effective use of inputs and intercultural practices for increasing crop productivity considering economic factor, availability of inputs and technical feasibility. BMPs increase efficiency of applied inputs and services, i.e. more return per unit of investment.

Introduction

Onion is an important vegetable crop of Nepal. It is grown best where the climate is mild without extreme heat/cold or excessive rainfall. Lower temperature (12 – 21°C) & short photoperiod promotes vegetative growth while higher temperature (20 – 28°C) & long photoperiod supports bulb development.

There is continuous decline in onion production of Nepal. Domestic production meets less than 45 percent of the market demand resulting in huge amount of onion imports from India and China every year. The main reasons of decreasing production of onion are lack of high yielding varieties, unavailability of quality seed of recommended varieties, early bolting before bulb formation, shortage of chemical fertilizers and lack of proper storage facilities.

Use of high quality seed or any other inputs alone is not sufficient to increase crop yield to a desired level. To get higher economic returns from onion crop, use enough organic manure and fertilizers, proper irrigation together with high quality seed are equally important. Therefore, BMPs should be followed by effective use of such available inputs and their local adaptation for increasing crop productivity, considering economic factor and different socio-cultural aspects. Practical definition of BMPs - refers to the right and effective use of inputs and management of cultural practices for increasing crop productivity considering economic factor, availability of inputs and technical feasibility of crop production. BMPs include:

- i) choosing the most suitable variety for each field
- ii) using of high quality seed
- iii) production of healthy seedlings
- iv) proper field preparation and planting
- v) sufficient application of organic manure
- vi) optimal use of inorganic fertilizers
- vii) timely irrigation
- viii) keeping field free from weeds, pest and diseases, and
- ix) harvesting at right stage of crop

- x) grading and storage
- xi) selling product at right price

Planning for onion production

A farmer must have a plan for onion production. Plan includes which field/ how much land is going to be planted with onion, what variety will be planted (and why), based on the season, location, market, cost of production and disease/pest. Farmer should be sure about source, quality and price of seed and fertilizer required. If equipment are to be used what is situation of availability and its cost. Are there some crop specific requirements for the equipment, such as irrigation, hoeing/weeding and postharvest? The farmer also estimate his/her other resources, such as how much FYM/compost is available, how many laborers are in his/her own family and how many to be hired. It is also important for the farmer to know what will be calculated cost of production and the total estimated market values of the crop. The farmer should have a schedule of activities, so that s/he can arrange the resources and implement the activities timely in a planned way.

Choose the most suitable variety

Fields differ in their soil fertility, available irrigation facilities, climatic conditions, cropping patterns, other inputs and access to market. Therefore, selection of a variety that suits growing conditions ensuring higher yields and minimizing risk of crop losses should be considered. A suitable variety should give good yields and fetch high price in the market. For higher yields and economic returns, improved high yielding varieties and hybrid seeds should be selected. Improved varieties are usually resistant diseases, more responsive to mineral fertilizers and better management practices for higher yield better profit of growers.

Table 1. Popular high yielding varieties (hybrid) of onion

SN	Variety	Recommended areas	Days to harvest (after transplanting)	Yield (t/ha)	Remarks
1	Red Creole	Terai, hills and high hills	150-160	20 -26	
2	Nasik 53	Terai and Mid hills	130-165	20 - 24	
3	Superex	Terai and hills	130-150	35-38	F1

Use of high quality seed

Good quality seed is pure, possesses high germinations percentage, right moisture contents and weight, and is free from disease and pest. Use of quality seed reduces seed rate, produces healthy and strong seedlings, gives uniform crop stand and results upto 20 to 25% increase in yield. It possesses better capacity of efficiently using other production inputs. Good seed should be clean, pure and healthy.

Clean: contains no foreign particles - stones, soil particles and weed seeds

Pure: contains seed of only one variety

Healthy: full size seed, same color, without any disease and pest organism

Because onion seed has short viability period, in any case, no seed older than one year should be used.

Therefore, buy certified seed from reliable shops that is truthfully labeled with packaging date.

Variety selection for specific conditions (climate, soil, fertilizer, irrigation, labor, etc.)

- Locally adaptable and suitable to wider range soils
- Resistant to biotic and abiotic adverse condition
- Better responsive to fertilizers
- Choice of all actors of value chain of the crop
- Tested at multi-locations before release and registration, which is safe to use

Cropping calendar of onion

A crop calendar is a picture of onion production seasons – from land preparation, nursery raising, irrigation, fertilization, weeding and other cultural operations to harvesting. It also indicates what was planted before and what will be planted after onion crop. In a crop calendar, farm activities are planned in a chronological order to perform them at the right time. It makes easier to organize labor and obtain inputs such as seed and fertilizer.

Figure: 1. Cropping Calendar of onion

Domain	Jan	Feb	Mar	Apl	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Hills												
Mid Hills												
Lower hills and Terai												
Off season onion production from set in Mid hills												
Off season onion production from seedlings in Mid hills												

Legend

Seed sowing	
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Transplanting	
Set harvest	
Set sowing	

Off season onion production from sets

Off season onion is produced in mid hills from October. The altitudes between 600 to 1500 masl is considered good for off-season onion production. In October 40 -50 gm seed is sown per square meter of the nursery and sets are harvested in April, which have 1.5 to 2 cm diameter and 8 - 10 gm weight. The harvest sets are stored in bunches hanging at dry place at barandas or stores in house. For one hectare of onion crop 1200 - 1400 kg sets are required. The sets are planted in:

- Mid hills up to 1500 m - July to late August
- Valley and flat land of lower hills - second half of August
- Terai and inner terai - first three weeks of September

The onion sets are planted at the spacing of 20 x 15 cm. The sets produce off-season onion bulbs in November and December when there is scarcity of onion in the market. When larger size of sets are planted there is cracking of bulbs and bolting. When smaller size of sets are planted there may be no bulb formation and the size of bulbs is too small. When sets are planted for spring onions, bigger size of sets are preferred. Spring onions are ready for harvest after 30 - 40 days of set. The varieties, namely Nasik Red, Nasik Red - 53, Agri. Found Dark Red, etc. are preferred varieties for spring onion production.

Off season onion production from seedlings

Since last few years technology for off-season onion bulb production is being developed and extended. The variety Agri. Found Dark Red is extensively used for the off-season onion bulb production, while N53 variety is also used some times. For this nursery is raised in:

- Mid hills up to 1500 m - third week of June to second week of July
- Valley and flat land of lower hills - Third week of June third week of July
- Terai and inner terai - last two week of June

The 30 to 40 days old seedlings are transplanted in sunny field with sloppy terraces or in the field where drainage system is better maintained. The bulbs are harvested in November and December. The following points should be taken in to consideration while producing off-season onion:

- Prepare raised bed nursery and provide shade to protect seedlings from rains
- Spray 1 gm Bavistin/l water solution in the nursery during rainy season to prevent possibilities seedling rot

- Since off-season onion plants do not die or necks are not broken even when they are ready for harvest. Look at the bulbs after uprooting a few plants whether the bulbs are ready or when there is initiation of bolting, this is right stage of harvesting
- Since the leaves of off-season onion are fully green even at the time of harvesting, cut the stem 2.5 cm above the bulb. The leave can be sold in the market for extra income, when the price of the leaves are NRs 30 - 40 per kg.
- Since the outer layers of the bulbs are not dry, curing of the bulbs should be kept in dry and open place for 20 - 25 days and then sold in the market as soon as possible

Land preparation for onion planting

Shallow ploughing is done, as the onion roots do not penetrate deep in the soil, and mainly upper level of the soil is made friable and loose. For a good field preparation apply 30 - 40 tonnes organic manure/hectare in soil at least 15 days prior to onion transplanting. Incorporating OM at least 15 days earlier than planting time ensures immediate availability of its nutrients to transplanted seedlings. Additional OM is applied in sandy soil to improve soil texture and moisture retaining capacity. Two to three ploughing/digging is required to make the soil pulverized. Level the field well to ensure even crop growth, reduce weed population and maintain uniform moisture in the soil.

Organic manure (5 kg/m²) is also applied in the nursery plot 30 days before seed sowing

Onion nursery bed preparation

Good seed together with well prepared and managed nursery produces healthy seedlings, which is a better start for onion production. After transplanting, the healthy seedlings grow faster and cope better even with poor soil fertility, weeds, pests, and diseases.

Nursery site selection

A good nursery site should be at sunny, elevated and easily accessible place with loam soil, near source of irrigation, and good drainage capacity. In order to avoid possibilities soil borne diseases, the nursery site must not have any crop of onion family, such as onion, leek and garlic grown there. Nursery bed soil is ploughed 2 to 3 times until the soil is fine tilled. If the soil is clay then sufficient amounts of compost is added to make the soil loose for proper drainage, moisture retention and soil aeration. For 1 hectare onion crop the nursery bed is 1 m wide, 500 m long and 5 to 10 cm raised from the ground level.

A space of 40- 50 cm is left in between two nursery beds which helps in weeding, watering, management of disease and insect pest. The space between nursery beds is also for draining out the excess rain water (if required) from the nursery. The beds should be prepared in the east and west direction with lines vertical lines from south to north in the beds for seed sowing.

Organic manure and fertilizers help produce healthy seedlings by providing nutrients to increase growth and vigor of seedling. For 500 m² nursery bed 5 kg DAP and 5 kg MOP incorporated in

upper 5 cm of surface soil before seed sowing. *After 20 days of seed sowing 5 kg gm urea is top-dressed in the nursery.*

Seed sowing

Seed is sown nearly two months prior to transplanting. For one hectare onion crop, 8 kg improved varieties or 5 kg hybrid seed is required. Seeds are placed 2 cm deep 0.5 cm apart uniformly in lines with 5 cm spacing, then seeds are covered with fine soil or vermicompost. The nursery bed is watered uniformly with rose-cans to fully moisten the soil. The seed sown bed is covered with polythene sheet in the winter (November /December) till sprouting of seeds. The polythene cover is removed in the daytime, if the temperature under plastic goes over 35°C and again bed is covered in the afternoon. For uniform germination enough moisture is maintained in the nursery bed. The polythene sheet used for mulching may also be used for polythene tunnel, after germination of seed, to raise temperature in side plastic tunnel in order to minimize effects of outside low temperature in the nights of winter season.

Instead of polythene sheet dry straw or jute sheets are used as mulch after seed sowing in the nursery bed in the summer (June and July) till germination of seed is complete. Plastic or thatched shed is used to protect the nursery from sun and rain.

Note that, onion seed has a habit of springing (jumping) at the time of sprout coming out from the seed coat. Due to this nature of seed, many seeds come out on the surface or jump away from the nursery bed. Such seeds die under sun reducing number of seedlings in the nursery.

Therefore, the nursery should be covered with plastic sheet or straw/ jute-sheet to minimize springing out of seed from the seedbed.

Nursery supervision and seedling protection

Onion nursery should be supervised regularly to ensure timely action required for better growth and development of seedlings. Supervision is done to make sure that seedbed is fully mulched/covered till seed germination is complete. A protection of the nursery (fence) from chicken and animals is preferred. Nursery bed is given daily light watering till germination and alternate day watering may be enough after germination of seed. However, water requirement of nursery also depends on season, soil type, weather and age of the seedlings. If nursery soil is sandy and/or nursery bed is raised too high, it is likely that there will be moisture stress in such nursery – daily watering may require. Nursery should never dry out.

Weeding and hoeing in the nursery is done as required. After 20 days of seed sowing 5 kg urea is top-dressed in 500 m² nursery raised to plant one hectare field. In case of pest/disease problem the farmer should contact agriculture technician and/or agro-dealer.

The seedlings become ready for transplanting after 7 to 8 weeks after seed sowing.

Field preparation for seedling transplanting

The already ploughed and leveled field after incorporating organic manure before transplanting time is divided in planting beds of 1.5 - 2 m width and 4 -6 m long. The planting beds are separated by small bunds of 10 to 15 cm high, this helps better irrigate the crop. Sometimes, a shallow

ploughing may be required to make the soil friable and loose, if soil is compacted over time. Each bed is connected with a 30 cm wide and 15 cm deep irrigation channel for irrigation.

Hardening and uprooting of seedling

Seedlings are hardened for 4-5 days before transplanting in the field. Hardening is done by

- Stopping irrigation for 4-5 days prior to taking the plants from nursery, and
- Removing plastic cover 2 -3 day before transplanting, if seedlings are grown under tunnel

However, the nursery bed is irrigated about 12 hr. prior to uprooting seedlings from the nursery to minimize root damage at the time of uprooting seedlings. The seedlings are taken with root soil from the nursery with the help of *khurpi* and put in tray or flat baskets to take them to field. Generally, seedlings are uprooted from the nursery in the afternoon and transplanted soon after that.

Fertilizer management

Most soils provide small amounts of nutrients, not enough for good crop growth and high yield. Fertilizers supply additional nutrients to the crop and improve crop growth and yields. Fertilizer requirements depend on crop variety, soil fertility, agro-climate and yield target. In principle, the amount of nutrient used by crop till harvest should be replaced by fertilizers. In one hectare of tomato crop 392 kg DAP, 134 kg MOP is applied and uniformly mixed in the 5 cm upper layer of soil at the time of planting. As todressing 368 kg urea is applied in two halves (split doses)- one after 25 -30 days of transplanting another after 60 -70 days after transplanting. Urea is uniformly broadcasted in the afternoon a day after irrigation. However, fertilizer application should be efficient and balanced to get maximum returns from the crop produced.

Transplanting of seedling

The seedlings are transplanted when they are 6-8 weeks old (14-15 cm tall). To transplant one hectare of onion field about 600,000 to 700,000 seedlings are required. Early sown onion gives a higher yield (larger size bulb) but the number of bolters may be more with low keeping quality. Late planted onion produces less numbers of bottlers, small bulb and low yield of good keeping quality bulbs. Sometimes before 1/3rd upper part of the green leaf is chopped and removed to reduce transpiration from the seedlings after transplanting. Seedlings are usually transplanting in flat beds .

Planting distance mainly depends on variety, season and fertilizer dose. Optimum plant spacing is required to ensure high yields. Close spacing increases competition for nutrients and light while wider spacing reduces efficient use of nutrient and light use by plants. The recommended planting distance is 15 cm between rows and 10 cm between plants.

Transplanting is done in the afternoon to minimize transplanting shock to seedlings. The seedlings are transplanted with the help of pick or *khurpi* just covering the lower part of seedling what was in the nursery soil. The soil around transplanted seedlings is lightly pressed to support the seedling. The transplanted onion field is irrigated within few hours of seedling transplanting. First irrigation after transplanting of onion is given with rose fitted hose pipe or watering cans to avoid possible uprooting of newly transplanted seedling.

Gap filling is done when some seedlings get damaged and died within a week of transplanting. If gap filling is not done, yield may reduce due to decreased plant population.

Keep field free from weeds

Weeds compete directly with plants for space, light, nutrients, and water and, thus, reduce crop yield. Early stage of onion plants is more sensitive to weeds. Weeding is also done before topdressing urea. It is done by hands or appropriate use of herbicides (chemicals that only kills weeds). While using herbicides, always read and follow the instructions on the product label-right herbicide at recommended rate and consult extension workers for guidance. The following points should be considered for weed management:

- Selection of right variety, clean and healthy seed and production of health seedlings, including all the recommended practices of crop management
- A good land preparation reduces weed population and supports crop development
- Weed control is also done by hand or by using herbicides
- Generally weeding and hoeing is done before urea top-dressing. The first weeding is done after 25 - 30 days of transplanting and second is done after 60 - 70 days of transplanting
- The weedicides should be used with full precautions. Read the instruction carefully and use only the prescribed dose and quantity of herbicide
- When there is problem of disease and pest consult with agri. technicians or agro-dealers for advice and support

Herbicides and pesticides are poison, if they are not used properly they can cause health and environment problems. Label them clearly and keep them out of children's reach.

Management of irrigation

Onion is sensitive to irrigation due to its shallow rooted plants and requires light but frequent irrigations. Requirement of irrigation for onion crops is weekly in the dry season (*and it is more when atmospheric temperature goes high*). Generally 8 to 20 irrigations are require – more in winter/spring crop (December to April) and less when there is natural rain in cropping season. The irrigation should just make the field wet with irrigation water. Over irrigation will be wastage of water and leaching of nutrients below the reach of onion roots. The first irrigation is given immediately after seedling transplanting. Delay in irrigation at this stage may increase seedling mortality. Bulb formation stage is another critical stage for irrigation and lack of irrigation at this stage results in smaller bulbs and low yield. Irrigation is stopped when the tops mature and starts falling before harvesting stage.

Urea top-dressing in onion crop

Nitrogen is one of the most important nutrient elements required for the production of crops. In order to increase efficient use of N, total quantity of urea is divided in two split doses, one is given 25-30 days after transplanting and another at 60-70 days after transplanting. Weeding and hoeing is done followed by light irrigation before urea topdressing. In each of the two top dresses

9.2 kg urea is applied. The topdressing urea is uniformly broadcasted by hand or spreader, preferably in the late afternoon.

Supervision of onion crop

It is important to supervise onion crop regularly to identify and determine necessary cultural practices required. Supervision helps make timely preparation and take necessary actions to minimize possible losses of the crop. Crop supervision is done to check the following things:

- Water/moisture level to determine need of irrigation or draining out excess water from the field
- Find out damaged hills of transplanted seedling and timely filling the gaps (dead seedling)
- Intensity of weed/need for weeding at right time to minimize effect of weeds on the overall growth and development of crop
- Determine right stage of urea topdressing
- Crop protection from animals or other pests
- Any other problems in the field and/or operations needed in the field (crop harvest)
- Look for pest and disease infestation and determine control measures
- Farmers are advised to consult extension worker and agro-vets for any service related to pest and diseases problem

Harvesting of onion

Green onions: Green onions are ready for harvesting 2 months after transplanting. Harvesting is done by pulling out plants by hand when there is a little bulb formation and good, tender vegetative growth.

Mature bulbs: The bulb crop is ready for harvest in 4-5 months after transplanting. Maturity is indicated by the tops falling (neck fall), while the leaves are still green. Harvesting starts when 60 - 70% of necks fall. Sometimes to enhance maturity of the onion, crushing of tops (topping) is done by physically breaking the onion necks. Onion should be harvested at right stage. When harvesting is delayed rooting takes place which uses nutrients in the plant. When harvesting is done before right stage bulbs are still tender with excess water which may negatively affect storage duration of the crop. The plants are hand pulled or dug by *khurpi* or spade. The tops at the neck and roots at the base are cut off before curing.

Curing of onion bulb

Curing is done to remove excess moisture from outer skin for reducing disease infection. Curing Onion plants should be dried in shade for 2 -3 days immediately after harvesting. Thereafter, leaves are removed keeping 2 -2.5 cm long neck and dried under shade and dry place. Onion bulbs are cured to prevent disease and pest infestation. Generally onion bulbs are fully cured within 3 to 4 weeks of curing. After curing excessive moisture in the bulbs is removed, bulbs become wighty and the outer skin is dry.

Grading and storage of onion

The purpose of grading and storage of onion is to improve the quality of product and prolong storage period. First of all the onion bulbs with disease, pest, sprout, split and injury are sort out. Then, the good quality bulbs are graded (sorted) in three according to their size:

- Bulbs with diameter 6 cm or above
- Bulbs of 4 – 6 cm diameter
- Bulbs of less than 4 cm diameter

The different size of bulbs are packed in crates, stored on racks or packed in sacks made of plastic net. The onion bulbs can be stored up to 6 months after harvesting in a clean, well aerated place at a temperature between 24 to 30°C. The stored bulbs are periodically supervised and disease infected and sprouting bulbs are sorted out, and the remaining bulbs are moved once or twice to turn their sides.

The bulbs (bulbs with disease, pest, sprout, split and injury) sorted out from the lot are sold quickly in the market at lower price and/or consumed by growers.

Transportation of onion to market

The graded, packed and stored onion bulbs are sent to market when there is a desired price in the market. While sending the onion bulbs to market, transportation is done in the night and cool weather. When onion is transported in bulk, straw cushion is used to minimize injuries due to rough road and heat. It is important to take care to minimize possible damage of onion bulbs while transporting to the market.