



Training Manual on Agronomic Practice of Selected Vegetable for Development Agents and Farmers at Kenbata Tembaro Zone (Kacha Birra and Angacha Woreda)

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Objectives of the training

1. To increase awareness of DA's and farmers regarding to irrigation system as well as reminding their responsibilities.
2. To aware project beneficiaries about proper management of irrigation system for sustainable utilization
3. To understand methods which helps for sustainable vegetable production using irrigation
4. To recognize different methods of vegetables production and managements

Methodology

Irrigation training is provided for development agents and farmers both as theoretical training and practical demonstration. After the training development agents will support the farmers in every day production activities with acquired knowledge from the training, therefore DA's should give attention during training.



1. Vegetable production using irrigation system

Beside household food security vegetable production have great contribution for household income however; the major problem for intensive vegetable production was lack of irrigation system therefore, by using irrigation system vegetable production helps for sustainable productivity. Therefore, in this manual explained some methods which helps to increase productivity and the sustainability of production.

1.1. Vegetable seedling management

We can produce vegetable through direct sowing and transplanting of seedlings. Vegetables which produce through direct sowing are carrot, potato, beetroot, lettuce, spinach and other. However, some vegetables produced through transplanting such as:- tomato, onion, pepper, head cabbage and others.

1.2. Challenges of vegetable production around kembata tembaro zone

- ❖ Disease and insect pest problem in both seed bed and main field.
- ❖ Poor management of seed bed results late maturity of seedlings, slow growth rate and low productivity.
- ❖ Excess seedling production which means produced seedling more than production land therefore, this cause loss in germinating seed, labor cost and loss in time spent for seedling management.
- ❖ Dalliance of seedling transplanting results poor survival rate and low production.

1.3. Criteria for establishment of vegetable nursery site

- Availability of water resource for irrigation system
- Topography of the land which allow vegetable production
- 10-15 cm depth loam soil
- 1 m diameter and 5 to 10 m length seed bed with 50 cm foot ways.



1.4. Seedling production methods

- Using seed bed
- Using seedling production tray
- Using plastic pots

1.4.1. Types of seed beds

- **Raised seed bed:-** 15-20 cm height from ground. Such type of bed best for clay soil and high rain fall.
- **Sunken seed bed:-** 15- 20 cm below the ground. Such type of bed good for area with low rainfall, dry season and sandy soil.
- **Flat seed bed**

1.4.2. Seed bed preparation and management

Put well decomposed compost on seed bed and depending soil fertility add 100 gram DAP/ NPS and 100 gram Urea then mix with soil. Prepare seed rows with 10- 15 cm length and 1-3 cm depth depending on crop type; sow the seed on prepared row within 1-3 cm spacing and then cover with soil however, thinning of seedlings which germinated out of recommended spacing helps for better quality product.

After covering with soil again cover with dried much grass with 3 -5 cm thickness; irrigate water using water can fitted with sprinkler. After 2-3 days of germination thinning with 2-3 cm diameter spacing.

During dry and hot season irrigate seedling every day however, during cold season depending on moisture content of seed bed irrigate the seedling every two days. Excess moisture favors disease and pest damage therefore drain excess water from seed bed moreover, through reducing soil compaction between each rows we can facilitate aeration and water holding capacity of the soil. During and hot season irrigate seedlings 3-4 days before transplanting this can help us to reduce damage of seedling after transplant and also the seedling should transplant early in the morning or late in the afternoon. Before transplanting the main field should be irrigated properly.



1.5. Common problems in vegetable field which produce using irrigation system

- ❖ Lack of proper spacing especially on irrigation lines.
- ❖ Poor field management
- ❖ Improper spacing between seedlings
- ❖ Improper application of fertilizer/ low fertilizer application than the recommended rate

2. Agronomic practice of different vegetables

Depending on the vegetable type agronomic practice and management is different therefore, it is important to see agronomic practice and management system of some commonly produced vegetable crops therefore, here explained as follow:-

2.1. Tomato (*Solanum lycopersicum*)

Requirement for growth

Altitude: - from 700 - 200 m.a.s.l suitable for growth however, from 1100 – 1900 m.a.s.l highly productive.

Temperature:- day temperature 21 – 27 °C and night temperature 10 – 20 °C however higher daily day and night temperature fluctuation and when the temperature variation greater than 6 °C it affect seed germination and seedling growth rate as well as flowering and fruit abortion and resulted low productivity. If the temperature greater than 30 °C it affect fruit setting, fruit maturity and fruit color.

Soil type

Light sandy loam soil with low water holding capacity and moderately acidic soil with pH 5-7 good for crop growth and productivity. In addition to this we should check soil and water alkalinity which means should be very low.



Characteristics of the crop

- Tomato varieties differ in growth, fruit characteristics and final product utilization.
- Naturally tomato crop is monoicous therefore cross pollination is not a problem for tomato fruit.
- Based on growth rate tomato crop is divided into three tall, medium and short.
- **The tall variety** with tall stem, duration of flowering time longer than others and gives fruit for long time. The tip always produces young leaf but not flower and it requires support for better product.
- **Short variety** with short stem and flowering is at once and also gives product for short time. After flower setting the tip does not produce new leaf and does not require any support.
- **Medium variety** with medium height and shares the characteristics of both tall and short varieties.
- In addition to growth characteristics tomato crops vary in fruit shape, size, color (internal and external) and nutritional composition.
- Tomato fruit weighs 20 – 170 g.

Agronomic practices

Tomato can be produced directly or through transplanting; however, both techniques have advantages and disadvantages and mostly the transplanting method is used.

Seed bed preparation and seed sowing

- Site selection and deep ploughing then preparation of seed bed with size of 1m * 5m or 1m * 10m and leave 40 cm space between beds.
- Apply 100 g DAP/NPS for 1*5m size bed and mix with soil and 100 g urea after seedling germination. If the bed size is 1*10m fertilizer application becomes double.
- For 1*5m seed bed apply 6 – 20 kg compost.
- Leave 15 cm from each edge and sow the seed with 2cm spacing and 1 cm depth.
- 4 g or 2 cock bottle lid seed required for each 1*5m bed and 300 g for a hectare of land.
- In 5 m² seed bed we can produce 1250- 1500 seedlings therefore; to produce seedlings which cover 1 hectare of land 400 m² seed bed is required.



- After germination thin the seedling with 3-5 cm spacing.
- After 28-40 days / 4-6 weeks) or 3- 4 leaf stage or 10 -15 cm height seedlings are ready for transplanting.

Seed bed management

- After sowing of the seed cover the bed with mulch grass of 3-4 cm thickness and watering of seed bed.
- Until seedling germinated water the seed bed with sprayer water can.
- When the seedling start germination remove the mulch grass and water using furrow irrigation.
- Proper weed, insect pest and disease management and cultivation is required to have healthy and productive seedlings.
- Using quality seed and crop rotation with other than crops belongs to *solanaceae* family helps to control disease and pest problem.

Field preparation

- The field should plough 25 -30 cm depth and level properly.
- For small field which managed by human power prepare beds with 70 cm sized bed and 30 cm for irrigation line with 25 cm depth. 30 cm spacing between seedlings with this spacing 33000 seedling will planted per hector..
- Usually the field prepared 60 -50 cm for irrigation line and 90 -100cm for seedling transplanting.
- However, for varieties which require support for example:- minimeker and marglob the bed size should be 100 cm sized.
- For varieties which do not require support for example:- roman VF, Napoli and trason the bed size should be 90 – 100cm.

Seedling transplanting

In main field seedling transplanted with 20 -30 cm spacing. Water the seedling immediately after transplanting through water line/furrow irrigation.



Fertilizer application

DAP or NPS

- Apply 200 kg per hector during field preparation or during transplanting of the seedling.

Urea

- Apply 200 kg per hector but in split the first application during up to 7 days of transplanting and the other half (100kg) after 45 days of transplanting. The application should be done between seedling then cover with soil and immediately irrigate the seedling.

Support preparation

- ✓ Marglob, money maker, miya, metadel, shinti, Gelila ... etc varieties require support therefore, support can help good air movement between plants, protection of fruit contact with soil and this can protect fruit from soil born disease; easy for chemical spray; helps to keep product quality and easy for harvesting.
- ✓ Support should be prepared during 20 to 30 days after transplant this means before formation of bud. the vertical support prepared between every four plants and horizontal every 20 cm.

Water utilization

- ✓ Starting from seed sowing up to harvest we should give appropriate amount of water for tomato.
- ✓ The size of irrigation line should be 50 -60 cm and to allow the movement of water from the beginning to the end the slop should be moderate.
- ✓ Irrigation schedule and amount of water depends on soil type, weather condition and the growth rate of the plant however, during the first three weeks after transplant we should irrigate every 3 or 5 days interval. If the soil is sandy and dry areas the interval should be shot and if the soil type is clay or with high water holding capacity and wet area the interval should be longer.
- ✓



- ✓ Tomato crop sensitive for water shortage during transplant, flowering time and during fruit setting therefore, we should give appropriate amount of water during those periods.
- ✓ The fruit may not mature at same time therefore, after every harvest we should give water.

Weeding and cultivation

- ✓ Depending on the variety tomato fruit mature from 90 to 100 days after sowing.
- ✓ Fruit maturity for harvest depends on consumer interest and target market. For example for household consumption harvest when it is full red but for distant market harvest during half red stage.
- ✓ During harvesting and postharvest handling avoid damages such as bruising, compaction and other which affect product quality and shelf life.

Productivity

Tomato crops gives 300 to 600 quintal per hector however, the productivity depends on crop variety and management activity.

Good experience in tomato production at Angacha

At Angacha woreda in 2016 during off season production high tomato productivity was recorded. This result recorded from Adancho kebele the average altitude of the location is 1900 m.a.s.l. the farmer name is Mr. Abriham Lamango who produce 593 quintal per hector.

Cost benefit analysis

Production cost

- Labor cost = 40,000 ETB
- Input/ seed = 15,000 ETB
- Input/ fertilizer = 6900 ETB
- Chemical = 2980 ETB
- Fuel and oil for irrigation system = 19020 ETB
- Other cost = 30,000 ETB
- Total cost = 113900 ETB



Income/benefit

During production season price for quintal of product was 750 ETB and from total production $593 * 750 = 444750$ ETB income generated however, the net profit ($444750 - 113900$) = 330850 ETB was obtained.

2.2. Carrot /*Duncus carota*

Favorable condition for growth

- Average altitude 1900 m a.s.l
- Temperature from 16 – 24 °C
- Soil type light to moderate water holding capacity
- Soil acidity from 5.5 -7 pH

Adapting varieties

- ✓ **Nantus:-** orange in color with strong stem and the root oval in shape and flat at the end.
- ✓ **Chantenay red:** as compared to nantus variety deep orange in color, has shorter stem and the root oval shape and pointed.
- ✓ **Emprater, gold spikes and gold pack:** as compared to nantus variety those varieties have long shelf life and ease for long distance transport.

Field preparation

Proper tillage is very important to fine texture then preparation of irrigation line with 70 cm distance.

Amount of seed

- 3.5 to 4 kg per hector
- Mix seed with sand 3:1 ratio mix properly and sow the seed in prepared row.



Sowing method

- Seed sown in row in left and right side of the irrigation line. There should be 30 cm distance between each seed row.
- Seed sown in 1-2 cm depth.
- To keep proper spacing we can manage during seed sowing however, we can also manage through thinning.

Fertilizer application

- ✓ 100 kg DAP/ NPS and 50 kg urea per hector before seed sowing.
- ✓ Apply additional 50 kg urea after 30-40 days.
- ✓ Apply all fertilizers 10 cm distance from seed row and 5-10 cm depth.

Irrigation

- ✓ After seed sown irrigate properly.
- ✓ Irrigation schedule depends on the soil type and production season however, excess water should remove from the field.

Weeding and soil management

- ✓ Starting from seed sowing we should remove weeds which compete for nutrient.
- ✓ Weeding, cultivation and soil management activity should be done before irrigation.
- ✓ During root development we should take care during weeding and cultivation.

Crop rotation

- Crop rotation with cereals and pulse.

Harvesting

- Harvesting by hand possible when the stem thickness is 2cm and above.
- After harvest remove the leaves and wash the root.
-
-



- We can store carrot root in side pit around home however, we should avoid entrance of water to pit. Also we can store carrot inside well aerated store but we should avoid entrance of light which affect carrot quality.

Productivity

- 250- 400 quintal per hector
-

2.3.Onion /*Allium Cepa*

Favorable condition for growth

Altitude: from 700 – 2000 m.a.s.l

Temperature: day temperature range 20 – 26 °c and night temperature ranges from 11 to 15 °c.

Soil type: light sandy loam soil good for onion growing however, black clay soil which crack easily and pH ranges from 6-7 is not good for onion growing.

Seed bed preparation and seed sowing

- Onion can produced in two ways through direct sowing and transplanting but transplanting is the best.

Seedling production

- ✓ The where used for seedling production should be with moderate slope, light loam soil, water available near around and no tree shading.
- ✓ On one hector onion production 120 seed beds with 1m*5m or 60 beds with 1m*10m were required.
- ✓ There should be 50 cm distance from each bed in every direction.
- ✓ In each beds prepare seed rows with 15 cm spacing between every lines.
- ✓ Sow the seed with 2 cm spacing each other and 1 cm depth.
- ✓ 4 -6 kg seeds were required per hector; 30 g for 1*5m bed and 60g for 1*10m seed bed.
- ✓



- ✓ 100g DAP/NPS and 100g urea for 1*5m bed and 200g DAP/NPS and 200g urea for 1*10m bed is required for seedling production.
- ✓ Transplant the seedling when the height of the seedling reach to 12 -15 cm.

Seedbed management

- ✓ Cover the bed with mulch grass after sowing the seed and irrigate water with sprinkler.
- ✓ The seedbed should irrigate twice per day early in the morning and late afternoon and keep the soil moist.
- ✓ When the seed start germination remove mulch grass and we can irrigate through irrigation line/farrow irrigation.
- ✓ Weed and pest management and control is very important in order to have vigorous seedling.

Field preparation

- ✓ The field should tilled to soft soil texture then prepare the irrigation line with 40 cm spacing.
- ✓ 1 or 2 days before transplanting the field should irrigate.
- ✓ Better to transplant seedling early in the morning and late in the afternoon.
- ✓ Leave 5 cm at the bed edge during transplant the seedling on prepared bed.
- ✓ 20 cm spacing between row and 5-10 cm spacing between plants.
- ✓ Irrigate the field immediately after transplant.
- ✓ 330, 000 seedling is required to cover one hector of land.
- ✓ Replace dead seedling 7-10 days after transplant.

Fertilizer application

- ✓ 200 -400kg DAP/NPS per hector and apply after field preparation and mix with soil.
- ✓ 200-300kg urea per hector and apply half during transplant and the remaining half after 45 days of transplant.



Irrigation

- ✓ During the first 3 to 4 weeks irrigate every 4-5 days. During this time the root is around 30cm therefore, light irrigation is required.
- ✓ The soil up to 30cm should keep moist.
- ✓ During dry season and sandy soil irrigation frequency should be short however; during wet season and clay soil the frequency of irrigation became shorter.
- ✓ During root setting critical time for moisture therefore; during this time we should irrigate proper amount of water.
- ✓ 15 – 25 days before harvest stop irrigating onion and remove all weeds.

Cultivation and weeding

- ✓ Onion requires at least three times cultivation and weeding.
 - 1st round cultivation 15 days after transplant
 - 2nd round cultivation 30 days after transplant.
 - 3rd round 50 days after transplant.
- ✓ During 2nd and 3rd round cultivation remove excess soil from onion root and during maturity leave onion head above the soil.

Harvesting

- ✓ Onion matures for harvest 80 -90 days after transplant.
- ✓ Maturity index for onion is senescence of 50 % young leaves.
- ✓ When mature enough remove head from soil using fork and expose to direct sunlight for five days. To avoid damage by sun light cover with leaves.
- ✓ After dry remove the leave and root then store in dry and well aerated store.

Productivity

- 300 -600 quintals per hector.



Good experience of onion production at Angacha woreda in 2015

- Mr. Abriham Lamango lives at Adancho kebele and he produces 370 quintal per hectare and recorded highest production in the woreda therefore, we look his cost and benefit calculation as follows:-

Cost benefit analysis

Cost analysis

- Labor cost -19000 ETB
- Seed purchase = 8000 ETB
- Fertilizer cost = 5850 ETB
- Oil and fuel for water pump = 8200 ETB
- Pesticide = 1015 ETB
- Other cost = 1216 ETB
- Total cost = 43281 ETB

Benefit/ profit

- At a time local price of onion per quintal was 900
- Total price $370 \times 800 = 296000$ ETB
- Net profit $(296000 - 43281) = 282719$ ETB.

2.4. Head cabbage / *Brassica oleracea*

- ✓ The origin is temperate therefore, high resistance to cold weather condition
- ✓ For seed production it takes two seasons therefore, categorized in biennial plants.

Favorable condition for growth

- **Altitude:-** ranges from 500 – 1800 m.a.s.l
- **Temperature:-** from 5 -24 °C for growth and 15 -20°C better productivity.
- **Soil type:-** can grow any soil type.



- **Soil acidity:-** pH from 5.5 -6.5 good for growth but acidic soil not good for growth.
- Wet land is not favorable for cabbage growing.

Adapted variety

- ✓ **Copenhagen market:-** rounded head, deep green leaf and depending on the environmental condition it takes 110 days or maturity.
- ✓ **Early durum head:-** flat tip head, light green leaf and it takes 90 days for maturity.

Field preparation

- ✓ Preparation of main field properly and irrigation lines 60 -75 cm distance.
- ✓ For proper irrigation better to use short length irrigation lines.

Seed requirement: - 400 – 600g per hector

Seedling preparation

- ✓ Sandy soil with good infiltration of water is preferable for seedling production
- ✓ Apply 10 -20 kg compost for 5m² seedbed.
- ✓ Apply 100g DAP AND 100g urea for 5m² seedbed.
- ✓ Sow the seed with 10 cm row spacing.
- ✓ After seed sowing cover with soil and then cover with mulch grass.
- ✓ Remove mulch grass when seedling starts germination.
- ✓ After 35 – 45 days or when the height reach 10 -15 cm seedling ready for transplant.
- ✓ One week before transplant stop irrigation to harden the seedling.

Transplant

- After 25 – 35 days or during 3-4 leaves stage or when the height of the seedling reach 10 - 15 cm the seedling is ready for transplant.
- To avoid damage on the root irrigate one day before transplant and remove seedling with soil.
- Prune large roots and transport seedling with wet sisal bag or cover with leaves.
- During transplanting use the following spacing 60-75 cm row spacing and 30 cm between plants.



- Better to transplant during late afternoon and avoid folding of roots.
- Irrigate immediately after transplant.
- 55333 seedlings can transplant per hector.

Water requirement and utilization

- ✓ Irrigate the field one day before transplant.
- ✓ Depending on soil type and weather condition irrigate every 6 to 12 days.
- ✓ During dry season and sandy soil irrigate every 6-8days.
- ✓ Humid weather and soil with high water holding capacity irrigate every 10 -12 days.
- ✓ Before irrigation remove all weeds and remove excess water from the field.

Fertilizer application

- ✓ Apply 50 kg DAP/NPS per hector during transplant and 100kg urea half during planting and the remaining 30 – 40 days after transplant.
- ✓ Apply fertilizer 10 cm far from the plant root and 5-10 cm depth then immediately cover with soil and irrigate water.
- ✓ Combining compost with commercial fertilizer gives better result.

Weed control

- ✓ Immediately after transplant we should control all weeds.
- ✓ Remove all weeds and cultivate the field before irrigating the field.
- ✓ We should take care to avoid damage on root of cabbage during cultivation and removing of weed.

Crop rotation:- cabbage can rotate with cereals and pulse.

Harvesting

- When cabbage head mature the head become stronger and during this stage we can collect the product through cutting the head with machete.
- 300 -420 quintals can produce per hector.



3. Disease and insect pests which affect vegetable production using irrigation

Vegetable production and productivity mainly affected by improper management this may cause susceptibility of crop to disease and pests therefore, the following points which can help to reduce disease and pest damage on crop this can results increasing of productivity.

➤ Productivity of different vegetables which managed properly

- Tomato 300 -600 quintal per hector
- Head cabbage 300 – 420 quintal per hector
- Carrot 250 -400 quintal per hector
- Onion 300 – 600 quintal per hector

Damage caused by disease and pest

- **Blight on potato/ tomato:** - cause 50 -70% losses in product if the environment is conducive it can cause 100% loss.
- **Powdery mildew on tomato:** - 10 – 90% loss in product.
- **Bacteria blight on tomato:-** cause 60% loss which means loss in 180 quintal per hector.
- **Tomato fruit borer (tuta absoluta):-** 50 -100% reduction in quality and productivity.
- **Onion purple Blotch damage:** - cause 10 -90% loss sometimes 100% losses.
- **Club rot on head cabbage:-** cause 50 – 100% loss.

3.1. Why disease and pest cause damage

- ✓ Improper land preparation and late sowing; production of crop with similar family year after year.
- ✓ Lack of follow up of crop damage by pest however, follow up and identification of damage encounter 50% of pest control.
- ✓ Not taking immediate response for pest damage.
- ✓ Using infected seed
- ✓ Branches and fruit direct contact with soil especially for tomato.

3.2. Why pest control difficult for local farming community?

- Less professional support for farmers.
- Improper application of pesticides.
- Less understanding of life cycle of pest.
- Lack of proper identification of pests.
- Lack of practical demonstration on pest control or knowledge gap.
- Mixed application of different pesticides.
- Lack of proper irrigation of adequate amount of water.
 - Less amount of water cause flower shoot rot.
 - Excess water causes damping off.
- Lack of inclusion of pest control under technology package.
- Less attention was given for pest control.

4. Different methods of pest control

Insect pests which affect tomato

African Boll Worm

- Corn Earworm
- Tomato Fruitworm
- *Helicoverpa (Heliothis) zea*
- moth



Control methods

Cultural methods

- ✓ Ploughing the field during dry and sunny season to expose worms to direct sunlight and other predators.
- ✓ Collecting and killing of worms.
- ✓ Removing weeds which create favorable condition for pests.

- ✓ Using resistant varieties such as melka salsa and melka shola.

Using chemicals

- ✓ **Young worms only controlled with chemicals.**
- ✓ **Apply chemicals during flowering stage and fruit maturity**
- ✓ **Apply the following chemicals:-**
 - **25% sypermetrin / 10% Sypermetrin E.C diluting with 1L. water;**
 - **agro-lambasin super 315 E.C** (Profenofos 30% + Lambda cyhalothrin 1.5% EC);
 - diamecron 100% E.C liquid diluted with 3.0 L. water;
 - carborile (sevin) 85% powder with 1.5 kg and diluted by water.
 - Hyway 50 E.C (Lambda-cyhalothrin) dilute with 200 -400L. water and apply for hector of land.

Tomato leaf miner *Tuta absoluta*

- First observed in rift valley vegetable producer and it cause 50-90% loss in product.

Symptom:- cream and whit colored small worms and green and brown color big worm on leaf of tomato

- During sever damage all leafs become dry.



Symptom

The hole made by worms serve as entry for other disease causing pests and show rot sign

Control methods

Cultural practices

- ✓ Cleaning field and place around the field.
- ✓ Deep ploughing of field to expose worm for uncondusive environment.
- ✓ Use pest free seedlings and planting bottle ground around the field.
- ✓ Use clean packaging materials.
- ✓ Crop rotation with other than *solanaceae* families.

Using chemicals

- The following chemicals are recommended to control tomato leaf miner in the country.
- ✓ Coragen 200 SC (chlorantranliprole 200 g/L) :- apply 50 mL. per hector.
- ✓ Tracer 480 SC (Spinosad):- 150 mL. per hector.
- ✓ Ampligo 150 ZC (chlorantranliprole 100g /L + λ- cyhalothrin 50 g/L) :- 300 mL. per hector.
- ✓ Radiant 120 SC (Spinetoram):- 130 mL. per hector and apply 2-3 times in production season.

Tomato leaf miner

- Two-Spotted Spider Mites
- Red Spider Mite
- *Tetranychus urticae*



Control methods for two spotted spider mites

Cultural methods

- ✓ Dry and hot condition favorable for spider mites therefore applying fine mist of water every two days helps to control those pests.
- ✓ Light damage can control through cultural methods.

Using chemicals

- ✓ Apply pyrethrum deris on front and back side of leaf every 5-7 days.
- ✓ Apply 1L. Dimeteriote/ rouger 40% diluted with 200 -400 L. water for a hector of land.
- ✓ Dynamic 1.8 EC (Abamectin 18 g/L) seciyor 36% SC (Chlorfenapyr) locally produced isecticides.

Blossom end rot on tomato

- ✓ The main cause is calcium deficiency during flowering and fruit setting stagers. Improper irrigation of irrigation aggravate the problem.

Sign for blossom end rot on tomato



✓

Control method for blossom end rot on tomato

- Proper irrigation and application of fertilizer which contain calcium.
- Improve soil fertility through applying compost.
- Treat acidic soil with limestone which contains calcium two month before plantation.

Disease which affect tomato production

Disease which tomato

➤ Bacterial spot

- Causal agent *Xanthomonas campestris pv. vesicatoria*



Control methods

Cultural methods

- Using disease free seed or seedling.
- Crop rotation between different families.
- Proper management of water irrigation to avoid excess amount of water.

Using chemicals

- ✓ If the disease occurred on seed bed apply 25g Edolkocide 101 powder mixing with 15 L. water. Apply before transplant of seedling to main field.

- ✓ Apply 2-3kg kocide or 2-3L. chlorotanol 720 per hector mixing with 200 -400 L. water.
- ✓ If the weather is cloudy and disease severs apply bactericide every 7-10 days starting from fruit setting to harvesting.

Tomato late blight/ *phytophthora infestans*

Tomato late blight

- ✓ *phytophthora infestans*
- ✓ damaged leaf, steam and fruit



Sign :- rounded or shapeless blight on edge of young leafs and then expand to whole leafs and blue color.

- Cottony white colored disease causing agent is observed around blight spot especially on backside of the leaf during morning.
- When the weather is cloudy and humid favor for multiplication of disease causing agent and results drying of the whole leafs within 1-2 weeks.

Control methods

Cultural practices

- Using disease free seed and seedlings.
- Avoid shading effect and water lodging around plants.
- Remove all weeds.
- Avoid production of crops belongs *solanaceae* family on the field where disease occurred at least for coming three years.

Resistant varieties of potato

- Tolcha
- Wochecha
- Digemegn
- Plane

Using chemicals

- Apply fungicide 20kg Redomil 65% powder per hectare mixing with 200-400L. water.
- ❖ Result of study done around central rift valleys showed that applying the following chemicals in given concentration controlled late blight.
- Redomil gold 68 WP 350g/100L.
- Fugomil 250g/100L.
- Mancozeb 72% (mancozeb + metalaxyl) (250g/100L).

Early Blight

- *Alternaria solani*
- Damage plant leaf



Control method

Cultural methods

- ✓ Using disease resistant varieties.
- ✓ Use disease free seed or seedlings.
- ✓ Crop rotation with cereals and pulse every 3 years.
- ✓ Remove diseased plant from the field.
- ✓ During cold and cloudy days avoid irrigation.

Using chemicals

- ✓ Treat 1kg seed with 100g methalicile powder before sowing.
- ✓ Apply the following pesticides per hector of land every 7-10 days such as:- 22kg chocide 101 powder or 3kg redomil MZ 63.5% powder or 720 mL. chlorothaloline diluting with

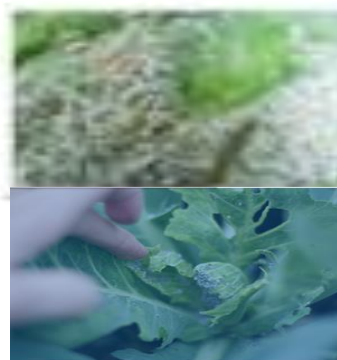


2-3 L water or 3kg Mancozeb (pecozeb) powder mixing with water or azosystrobin (chodris), manibe and zinib mixing with 200 -400L. water.

Insect pest which affect head cabbage

Cabbage Aphids

- *Brevicoryne brassicae*
- Gray color and soft
- 4 cm height and oval shape



Cabbage Aphid control methods

Using chemical

- Apply the following insecticides per hector such as:- Dimethoite 40% or phormotone 33% liquid diluted by 1L. water or endosalphan 35% liquid mixed with 200L. or 0.5L. liquid Diazinon 60% mixing with 200-400L. water.
- Systemic insect sides which are effective and registered to control Aphid in Ethiopia are ;- Dimethoite, Thymethoxam and Emedachelorida.

Cabbage Looper

- *Trichoplusia ni*
- Warm
- measuring/looping motion is unique future of the this pest.



Cabbage hopper control method

Cultural method

- ✓ Collect and kill warm.
- ✓ Remove weeds which create favorable condition for pest.
- ✓ Kill or remove egg of the pest.

Using chemical

- ✓ When you observe a warm or leaf damaged by warm in one plant out of ten plant start chemical spraying. Use the following chemicals according to recommended rat.

-

- Apply the following insecticides per hector of land 1L. Liquid Dynamite 40% or phormothion 33% diluted by water or 2L. Endosulphan 35% diluting by 200-400L water.

Diamondback Moth

- *Plutella xylostella*
- Insect pest
- Green in color, pointed in two end and flat shape.
- when we shake the plant the pest move to ground in web.



Diamond black moth control method

Cultural method

- ✓ Collect and kill moth.

Using Chemical

Apply the following chemicals diluting by 200-400L. Water perhector.

- ✓ 1.5.kg Karbaril/ servin 85% mixing with water.
- ✓ 1L. Phenitheration/sumithone 50% diluting with water.
- ✓ 2L. Malathion 50% diluting with water.
- ✓ 1kg trychlorophon 95% mixing with water.
- ✓ 0.5L. Diazinon 60% diluting with water.

Disease which affect head cabbage

Damping-off diseases

- *Pythium spp.*
- *Rhizoctonia solani*
(*Thanatephorus cucumeris*)
- *Phytophthora* spp is fungal pathogen which cause disease
- it decay root, head and seed



Control method of damping off

Cultural practices

- Proper management of seedbed (control moisture and sun light).
- Don't use infected field for cabbage growing.
- Crop rotation at least for four years.
- Deep ploughing of the field.
- Using disease free and certified seed.
- Using disease resistant varieties.
- Allowing sunlight to seedbed.
- Thinning of seedling to allow direct sunlight to seedlings.
- Proper irrigation and fertilizer application.
- Avoid high moisture around root of seedlings.
- Remove diseased seedlings from beds.

Using chemicals

- Treating seeds with chemicals before sowing.
- Use the following chemicals to treat seeds.
 - 3-5g thyrem powder mixing with water for 1kg seed.
 - 10g apron star 42 WS mixing with water for 4kg seed.

Spraying fungicides for seedlings

- 2-3L. Ridomil gold MZ 63.5 WP mixing with 6L. water perhector
- 2-3 kg Mancozob 90 WP (Dithane M-45) mixing with 600L. water apply per hector every 10 days until the product harvest.

Cabbage Black Rot

Xanthomonas campestris is disease causing bacteria.



Control method for cabbage black rot

Using chemical

- Treat 1kg cabbage seed by 3-5g thiram before sowing.

Club-root

- Cabbage root damaging disease.
- *Plasmodiophora brassicae* is disease causing pathogen.
- Soil born disease



Control method for club-root

Cultural methods

- Treating acidic soil by limestone to increase soil pH above 7.3.
- Proper management of water irrigation to control soil moisture.
- Clean or avoid using infected materials such as:- disease transmitting seed and seedlings; flooding water, dust and infected farming tools.
- Avoid growing crop belongs to *crusifere* family.
- Use disease resistant varieties.
- Use integrated pest management such as:- crop rotation, field cleaning and others.

Using chemicals

- ✓ Fumigate seedlings by metham sodium.
- ✓ This chemical not available at local market therefore, better to use cultural method of disease control.

Disease which damage onion

Onion thrips

- **Onion thrips, thrips, thunderflies (Thrips tabaci) is disease causing pathogen.**



Control methods for onion thrips

Cultural methods

- ✓ Crop rotation.
- ✓ Don't rotate with cereals and pulse because this disease highly affects cereals and pulse.
- ✓ Repeated deep ploughing field every 15-20 days to expose inoculum to direct sun light.

Using chemical

- ✓ Apply 500 mL. actalic 50% liquid pesticide diluting by 200-400L. per hector of land.
- ✓ 1L. Deltametrin (desis) liquid pesticide diluting with 200-400L. per hector.
- ✓ 25L. Endosufan 35% diluting by 200-400L. water per hector.

Disease which damage onion

Downy Mildew

Peronospora destructor is disease causing pathogen.



Control methods for downy mildew of onion

Cultural method

- ✓ Use disease resistant varieties for example:- red chrayol resistant for downy mildew.
- ✓ Crop rotation with cereals, pulse and vegetables such as:- tomato, head cabbage, haricot bean and other.

Using chemicals

- ✓ Apply 2-3kg Redomil gold diluting with 600L. water per hectare.
- ✓ 2-3kg Apply Mancozeb (Dithane M-45) mixing with 600L. per hectare every 10 days.

Blue Purple blotch

Alternaria porri is a vector which transmit disease.



Control method for blue purple blotch

Cultural method

- ✓ By using disease resistant variety and certified seed.
- ✓ Using disease free seed and seedling.
- ✓ Crop rotation with tomato, head cabbage , haricot bean and other.

Using chemicals

- ✓ Treating seed with fungicides before sowing.
- ✓ Spry fungicides when disease appears.
- ✓ Apply 2-3kg Redomil gold WP mixing with 600L. water per hector.
- ✓ Apply 2-3kg Mancozeb (Dithane M-45) mixing with 600L. water per hector every 10 days.

Disease which affect garlic

Onion Rust

***Puccinia allii* (= *Puccinia porri*) is disease transmitter**



Control method for onion rust

Cultural method

- ✓ Cleaning field and remove all weeds, crop residue and volunteer *Allium* plants.
- ✓ Crop rotation at least for 2-3 years with crop belongs to other families.
- ✓ Using disease resistant varieties.
- ✓ Use disease free and certified seed.

Using Chemicals

- ✓ Spry fungicides when sign of rust observed.
- ✓ 0.5 kg tilt 25% WP mixing with 400-600L. apply per hector of land.

Pests which affect carrot

Red ant

- Gojam red ant
- *Dolynus spp* is belongs to ant family
- The larvae and adult stage of ant can damage crop



Red ant



Infested potato tuber

Control method of carrot insect pest/red ant

Cultural method

- ✓ Apply recommended amount of fertilizer.
- ✓ Treating soil with wood ash.
- ✓ Using resistant varieties.

Using chemicals

- ✓ 25 L. Chloropharuphos (Durisiban 48%) WP diluting with 200-400L. apply per hector.
- ✓ 1.5kg Karbaril (sevin85%) diluting with water and apply on ants until the soil wet.
- ✓ 250g Trychlorophone 95% mixing with 25 kg sawdust and 2.5kg molasses and moist with water and spread on soil during night time when there is no moisture.

Pests which affect beet root

Vegetable leaf miner

- *Liriomyza huidobrensis* is fly larvae



Control method for leaf mine on root beet

Cultural method

- ✓ Burn or bare all crop residues.
- ✓ Remove alternative host for pests from field.

Using chemical

- ✓ When sing of damage observed such as white lines on leaf apply Saromazine or Abamachitine according to user manual.