



World Vegetable Center



## WorldVeg's Improved Production Guide (IPG) for Cabbage in Assam



## WorldVeg Improved Production Guide (IPG) for CABBAGE Demonstrations in APART

Demonstration area: 0.15 ha

Days Before or After Transplanting	Activity	Description	Remark
35 - 30 DBT	Preparing coco-peat	Place 30 kg of <b>coco-peat</b> blocks or bricks in 300 liters of water for 24 hours. Attempt to break them down a few times. After complete expansion, fluff up and powder the <b>coco-peat</b> . Then, drain excess water.	If the <b>coco-peat</b> is not pre-washed by manufacturer, soaking and draining removes a lot of the high amounts of salts present in it. High concentrations of salts can be detrimental to seedling growth. Before use, the prepared powdered <b>coco-peat</b> must be moist and easy-flowing; but <i>not</i> wet, dry or sticky. <b>When squeezed, it should <i>not</i> expel water.</b>
35 - 30 DBT	Weed management	Remove weeds (and maintain weed-free conditions) within the nursery area, as well as in its immediate premises.	This can reduce outbreaks of diseases and insect pests. Weeds can serve as hosts and harbor pests.
30 DBT	Preparing potting mixture	To prepare <b>potting mixture</b> : Mix homogeneously, the prepared <b>coco-peat</b> , 40 kg well-matured <b>vermi-compost</b> and 40 kg <b>burnt/charred (not ash) rice husk</b> , along with 100 g <i>each</i> of <b>PSB</b> , <b>Azotobacter</b> , <b>Azospirillum</b> , <b>Pseudomonas</b> and <b>Trichoderma</b> microbial bio-agent formulations. Use coco-peat, vermi-compost and husk at approx. 3:1:1 by weight.	The <b>potting mixture</b> must be moist and easy-flowing; but <i>not</i> wet, dry or sticky. If <b>charred rice husk</b> is unavailable, use 40 kg <b>sawdust</b> instead. Microbial bio-fertilizers can enhance fertility and nutrient availability; microbial bio-control agents can prevent or reduce pest incidence.

30 DBT	Filling seedling trays	<p>If mono-cropping, fill with <b>potting mixture</b>, 83 <b>seedling trays</b> of 98 plugs [holes] each, for a total of approx. 8,000 seedlings. If intercropping, fill 62 <b>seedling trays</b> of 98 plugs each, for a total of approx. 6,000 seedlings. To fill: heap <b>potting mixture</b> over <b>seedling trays</b>; then, move a straight, flat object [such as a wooden plank] over the top of the trays, from one end to the other, to remove the excess <b>potting mixture</b>.</p>	<p><b>Seedling trays must be checked for presence of well-made holes at the bottom of each plug, to ensure proper drainage.</b> Poor drainage can lead to seedling loss and disease outbreak. Fill loosely; do <i>not</i> compress <b>potting mixture</b>; do <i>not</i> press down. <b>Seedling trays</b> with higher-than-recommended plug-counts may restrict seedling growth due to smaller plug-sizes.</p>
30 DBT	Seed treatment	<p>Uniformly mix crop <b>seeds</b> with 2 g <i>Trichoderma</i> formulation.</p>	<p>This can provide control of seed or soil-borne pests.</p>
30 DBT	Sowing crop seeds	<p>After filling <b>seedling trays</b>, using a pencil or similar object, make thin, 1.5-cm-deep holes in the center of each plug. Sow a single seed into each hole/plug. Cover holes with <b>potting mixture</b>.</p>	<p>Do <i>not</i> press down when filling holes after sowing. To cover holes, follow the same technique used for initially filling trays with <b>potting mixture</b>.</p>
30 DBT	Irrigating seedling trays	<p>Immediately <i>after</i> sowing, using a device that applies water gently, <i>lightly</i> water the <b>seedling trays</b> if moisture in the media is insufficient. For this <i>first irrigation</i>, <b>trays</b> may be covered with newspaper or cloth, and water applied gently through this layer.</p>	<p>Do <i>not</i> displace <b>potting mixture</b> during irrigation; this is important for satisfactory germination and seedling growth. <b>Seedling trays</b> can be typically irrigated once daily; but, apply accurately as required. Excess irrigation may drain away considerable amounts of crucial nutrients from the potting mixture.</p>

30 DBT	Stacking seedling trays	For approx. 3 days <i>only</i> , stack <b>seedling trays</b> in a zig-zag manner.	This can enhance speed and uniformity of germination. <b>Seedling trays must <i>not</i> be stacked when seedlings emerge.</b>
30 DBT	Maintaining seedling trays in nursery	After sowing, keep <b>seedling trays</b> on a <b>non-soil</b> surface in a protected structure or area; with abundant sunlight. Protect <b>seedling trays</b> from rain and hail by keeping them under a <b>shade net</b> or <b>removable plastic sheet</b> . If possible, keep nursery completely covered with <b>insect-proof net</b> . Do <i>not</i> keep nursery in damp or shaded places, or places with poor air circulation.	Keep nursery protected from rain. Ensure that <b>seedling trays</b> are <i>not</i> kept on a soil surface; they may be kept on concrete flooring or plastic sheet. On soil surfaces, seedling roots may penetrate into the soil through drainage holes in the <b>seedling trays</b> . Such contact with soil diminishes the purpose of using soilless media, by facilitating occurrence of soil-borne diseases. This also results in root damage when <b>seedling trays</b> are moved, leading to greater transplanting shock, as well as facilitating occurrence of soil-borne diseases. Lack of adequate sunlight can make seedlings lanky and weak.
30 DBT	Covering seedling trays	To improve germination in cool weather, after sowing, keep <b>seedling trays</b> covered [for approx. 3 days] with <b>black polythene mulching sheet</b> .	Covering <b>seedling trays</b> may enhance germination by elevating temperature within the <b>potting mixture</b> . Remove cover after a few days; <b>do not maintain cover after the first appearance of seedling emergence.</b>
30 DBT	Placing sticky traps	In the nursery, at the center of where <b>seedling trays</b> are arranged, at canopy height [approx. 15 cm above surface], place 1 <b>yellow</b> and 1 <b>blue sticky trap</b> .	Area of both <b>yellow and blue sticky traps</b> must be 22 cm x 30 cm. <b>Sticky traps</b> are used for safe, non-chemical control of insect pests.

20 - 15 DBT	Vermi-compost enrichment	To <b>enrich vermi-compost</b> : uniformly and thoroughly mix 250 kg well-matured <b>vermi-compost</b> with 400 g <i>each</i> of <b>PSB, Azotobacter, Azospirillum, Pseudomonas</b> and <b>Trichoderma</b> microbial bio-agent formulations.	Prevent <b>vermi-compost</b> from drying-out after inoculation; keep moist, store under protective structure away from direct sunlight. Do <i>not</i> wet excessively. Cover with <b>plastic sheet</b> if required. <b>Do not mix synthetic pesticides along with bio-agents.</b> Do <i>not</i> apply <b>enriched vermi-compost</b> on field at this time.
20 - 15 DBT	Plant protection	As a preventive measure against pest incidences [against sucking pests] in the nursery, spray over the seedlings (at 2 - 3 leaf stage) and on the floor of the protected nursery, <b>neem oil @ 0.4 mL per 10 m<sup>2</sup> @ 500 mL spray volume</b> (i.e. 0.8 mL per liter of water; i.e., 2 teaspoons in 10 liters of water).	Apply uniformly. Use <b>safety equipment</b> . Do <i>not</i> apply if windy. Use <b>cone-type nozzles</b> for spraying. Strictly <b>follow label instructions</b> . Be aware of <b>pre-harvest [residue] intervals</b> , for applications and harvest at proper times. Be aware of <b>re-entry intervals</b> after application.
20 - 15 DBS	Liming	If cropping system permits, apply finely powdered <b>lime</b> as required from soil testing. To increase efficacy, shallowly incorporate.	Use finely powdered <b>lime</b> for greater efficiency and efficacy; compared with coarser particles, finer particles provide greater surface area for reaction.
10 DBT	Planting border crop	Plant 3 rows of <b>maize</b> into 5-cm-deep furrows [made using a light tillage or marker implement] along the perimeter of the field, at 30 cm row-spacing and 20 cm in-row spacing.	<b>Border crops</b> serve as physical barriers against insect pests and disease vectors from entering the field. Typically, tall, fast-growing plants with dense foliage are selected as <b>border crops</b> . From <b>maize</b> as a <b>border crop</b> , economic returns in the form of a maize crop is also possible.

5 DBT	Tillage/ Field preparation	<p>Plow field, harrow cross-wise using multi-row disks or regular cultivators, to approx. 20-cm-depth. Then, level field with a shallow leveling implement.</p> <p><u>In case of zero-till production:</u> Do <i>not</i> perform tillage operations.</p> <p><u>In case of strip-till production:</u> Chisel-plow <i>only</i> along where crop will be planted. Do <i>not</i> perform other tillage operations.</p> <p><b>Mulch</b> with <b>rice-straw</b>, <b>arecanut-husk</b>, or similar material. If <b>intercropping</b>, and using off-farm <b>mulch</b> material, <b>mulch</b> after <b>intercrop</b> harvest. If using on-field [<b>rice-straw</b>] residue, keep <b>residue mulch</b> within the inter-row space until <b>intercrop</b> harvest; then, distribute <b>mulch</b> to cover inter-row space.</p>	<p>Use mold-board to turn up soil from approx. 30-cm-depth every 4 – 5 years. If needed, use rotovator/ rototiller to pulverize clods. Prepare fields at a time when rains may not necessitate a repeat of tillage operations [before planting]. Leveling is beneficial in preventing uneven water distribution. Zero-till and strip-till systems reduce damage to soil structure caused by tillage; plus they reduce soil erosion by reducing displacement and break-down of soil aggregates. Labor and time requirements for these systems may be lower; so they may reduce production costs, and reduce time-gap between harvest of one crop and planting of the next. To be fully effective, zero-till and strip-till may need to be combined with <b>mulching</b>.</p>
5 DBT	Hardening seedlings	<p>To <b>harden seedlings:</b> Reduce irrigation to <b>seedlings</b>, to create drought conditions. Move <b>seedling trays</b> out of protected nursery structures, exposing them to outside weather conditions.</p>	<p>Be careful <i>not</i> to let seedlings wilt during water deprivation. Pay attention to severe weather conditions; seek advise if needed. Hardening gradually acclimatizes seedlings to field conditions; so that they recover well following transplanting.</p>
5 DBT	Plant protection	<p><u>If <i>Spodoptera</i> is a serious problem:</u> Flood field to reduce population of pupae in soil.</p>	

1 DBT	Preparing transplant-ing media	To prepare <b>transplanting media</b> : Uniformly and thoroughly mix 15 kg <b>DAP</b> , 12 kg <b>MOP</b> , 500 g <b>Borax</b> , 100 g <b>Ammonium molybdate</b> , 250 kg <b>enriched vermi-compost</b> and 1,000 kg <b>FYM</b> . To mix: spread <b>FYM</b> over a wide area; then distribute <b>DAP, MOP</b> and <b>enriched vermi-compost</b> evenly over the <b>FYM</b> in different layers; then mix in from sides.	This <b>transplanting media</b> mixture must be easy-flowing/workable. It must be moist; but <i>not</i> wet, dry or sticky. The components must be well-blended so that the mixture is homogeneous.
1 DBT	Plant protection	If <u>damping-off</u> is a serious problem: Drench seedling roots in a solution of <b>chlorothalonil 75 WG formulation @ 2 g per liter of water</b> or <b>Fosetyl Al 80% WP @ 3 g per liter of water</b> .	Apply uniformly. Use <b>safety equipment</b> . Strictly follow <b>label instructions</b> .
1 DBT	Preparing transplant-ing pits	Make 15-cm-deep and 15-cm-wide <b>transplanting pits</b> , at 45-cm-row and 45-cm-in-row spacing [where seedlings will be transplanted]. If intercropping, use 60-cm-row and 45-cm-in-row spacing.	Alternatively, make 15-cm-deep and 15-cm-wide <b>transplanting furrows</b> ; then, <b>transplanting media</b> and seedlings placed according to in-row spacing.
Transplant-ing day	Transplant-ing	Put 150 g <b>transplanting media</b> into each <b>transplanting pit</b> [250 g if intercropping]; then, fix seedlings into the applied media @ 1 seedling per pit; then, cover each pit with its original top soil; and then, tamp down with the flat of palm or foot to anchor seedlings firmly.	Seedlings must be planted deep enough that they are <i>not</i> poorly anchored and leaning on soil surface; they must remain erect. However, leaves must <i>not</i> have soil contact. Transplant when weather is cool, without intense sunlight; such as during early morning or late afternoon hours.

Transplant-ing day	Planting trap crops	As <b>trap crop</b> , plant 1 row of <b>mustard</b> at intervals of 10 cabbage rows.	To ensure uniform seed distribution of tiny seeds, use filler materials during sowing. Sow in furrows; <b>do not broadcast</b> .
Transplant-ing day	Planting intercrops	<u>In case of intercropping</u> : Plant <b>intercrop</b> in furrows between crop rows. If <b>intercrop</b> is <b>amaranth</b> , plant 2 rows at 20-cm-row-spacing along the middle of crop inter-row spaces @ 200 g seeds per 0.15 ha.	Since <b>amaranth</b> seeds are small and light, ensure uniform seed distribution by using filler materials during sowing. Sow seeds in furrows; <b>do not broadcast intercrop seeds</b> .
Transplant-ing day	Irrigation	Immediately <i>after</i> planting operations are complete, irrigate.	Irrigate <i>lightly</i> if soil moisture is not low.
1 - 5 DAT	Plant protection	<u>If cut-worms are a serious problem</u> : [they snip the tender stems of seedlings] Spray <b>flubendiamide 48 SC</b> formulation @ 35 mL per 0.15 ha @ 75 liters spray volume (i.e. 0.5 ml per liter of water) or <b>Emamectin benzoate 5% SG</b> @ 112 g per 0.15 ha @ 75 liters spray volume(i.e. 1.5 g per liter of water).	Apply uniformly and use <b>safety equipment</b> . Do <i>not</i> apply if windy. Use <b>cone-type nozzles</b> for spraying. Avoid spraying before impending rain events. Strictly <b>follow label instructions</b> . Be aware of <b>pre-harvest [residue] intervals</b> , for applications and harvest at proper times. Be aware of <b>field re-entry intervals</b> after application.
1 - 5 DAT	Plant protection	<u>If damping-off is a serious problem</u> : Apply <b>chlorothalonil 75 WG</b> formulation @ 150 g per 0.15 ha @ 75 liters spray volume (i.e. 2 g per liter of water) or <b>Fosetyl Al 80% WP</b> @ 225 g per 0.15 ha @ 75 liters spray volume (i.e. 3 g per liter of water).	
5 - 10 DAT	Gap-filling	Replace seedlings that did not establish.	
5 - 10 DAT	Irrigation	Irrigate <i>after</i> gap-filling.	Irrigate <i>lightly</i> if soil moisture is not low.



10 - 15 DAT	Placing sticky traps	On bamboo-poles or wooden sticks, place 6 <b>yellow</b> [against whitefly, leaf miners, etc.] and 6 <b>blue</b> [against thrips, etc.] <b>sticky traps</b> [individual sheet size: 22 cm x 30 cm] <b>at crop canopy height</b> uniformly across the 0.15 ha field. <b>Replace sticky traps every 3 - 4 weeks.</b>	Establishing <b>sticky and pheromone traps</b> may be safer, easier and more cost-effective than chemical control of insect pests through multiple pesticide sprays. In addition, these are preventive measures designed to control insects pests in the initial stages of their infestation, thereby potentially preventing their population from increasing to economically damaging levels [which may then necessitate use of synthetic pesticides]. <b>Sticky traps</b> are <i>not</i> specific to a single insect species; <b>pheromone traps</b> however target a single major, devastating pest of the crop. Insects are attracted to the color of the <b>sticky traps</b> ; in case of <b>pheromone traps</b> , they are attracted to the pheromones present in the <b>lures</b> .
10 - 15 DAT	Placing pheromone traps	On bamboo-poles or wooden sticks, place 15 <b>water-based pheromone traps</b> uniformly across the 0.15 ha field, <b>30 cm above the crop canopy</b> . Use <b>lures</b> against diamondback moth. <u>If necessary</u> : Use <b>Spodo lures</b> against <i>Spodoptera</i> [6 traps]. <b>Replace lures every 6 - 7 weeks.</b>	
10 - 15 DAT	Placing bird perches	Place T-shaped <b>bird perches</b> made of bamboo, approx. 2-m-tall and 1-m-wide @ approx. 10 <b>perches</b> per 0.15 ha.	By serving as places to rest, and as vantage points, <b>bird perches</b> can facilitate feeding of birds on caterpillars, grubs, etc.
10 - 15 DAT	Weed management	Perform a shallow <b>weeding</b> around the crop plants.	Perform <b>weeding</b> when weeds are small, because at this stage, <b>weeding</b> is easier and provides better control. Make sure to <b>weed</b> within the crop row as well [at this stage] because this may be difficult later.

15 DAT - Harvest	Irrigation	<i>After weeding</i> , irrigate. Continue irrigation according to soil moisture conditions. <b>Keep soil always moist</b> . As a rough recommendation, irrigate at 10-day intervals, or after each harvest.	Do <i>not</i> irrigate heavily if soil moisture level is not low. Do <i>not</i> maintain water-logged areas. Do <i>not</i> irrigate excessively such that soil is always saturated. Irrigate evenly to maintain constant state of soil moisture; sudden drastic changes can lead to stress-related physiological problems.
15 DAT - Harvest	Plant protection	Frequently remove plant parts [leaves, fruits, etc.] affected by diseases or insect pests. Remove [and burn] them far away from cropped areas.	Do <i>not</i> discard the removed plant parts in the field. Field sanitation is important in preventing or reducing pest incidence, spread and build-up.
15 DAT - Harvest	Plant protection	If insect pest population is noticed, and is low, immediately spray <b>neem oil</b> @ 150 mL per 0.15 ha @ 75 liters spray volume (i.e. 2 mL per liter of water); then, approx. 3 days later, spray <i>Beauveria</i> or <i>Metarhizium</i> formulation @ 250 g per 0.15 ha @ 75 liters spray volume (i.e. 3 g per liter of water).	Apply uniformly and use <b>safety equipment</b> . Do not apply if windy. Use <b>cone-type nozzles</b> for spraying. Avoid spraying before impending rain events. Strictly <b>follow label instructions</b> . Be aware of <b>pre-harvest [residue] intervals</b> , for applications and harvest at proper times. Be aware of <b>field re-entry intervals</b> after application. Cover underside of leaves.
15 DAT - Harvest	Plant protection	If sucking insect pests are noticed, spray salts of fatty acids such as <b>Lastraw</b> <sup>®</sup> @ 375 mL per 0.15 ha @ 75 liters spray volume (i.e. 5 mL per liter of water).	<b>Neem oil</b> is applied prior to <i>Beauveria</i> and <i>Metarhizium</i> in order to weaken pests for infection by the pathogenic fungi. <b>Lastraw</b> <sup>®</sup> has a non-chemical mode of action and is safer than typically used synthetic pesticides. <b>Lastraw</b> <sup>®</sup> is available from Pest Control India Ltd.
20 - 30 DAT	Plant protection	As a preventive measure, spray <b>neem oil</b> @ 150 mL per 0.15 ha @ 75 liters spray volume (i.e. 2 mL per liter of water).	<b>Spray neem oil in the morning or evening [preferred] to reduce degradation by UV light.</b>


20 - 30 DAT	Intercrop harvesting	Harvest <b>intercrop</b> during this period when it is of marketable size and quality.	Do <i>not</i> delay <b>intercrop</b> harvest; this is crucial for growth and management of main crop. <b>Intercrops</b> are chosen to be short-duration, quick-growing crops that can utilize the inter-row space efficiently before the main crop canopy closes in, without interfering when this happens.
20 - 30 DAT	Weed management + Earthing-up	<i>After intercrop</i> harvest, perform <b>weeding + earthing-up</b> . Heap soil from the interrow space at the base of crop plants.	It is best to perform <b>weeding</b> when weeds are small, because at this stage, <b>weeding</b> is easier and provides better control.
20 - 30 DAT	Fertilizer application	<i>After weeding</i> , apply <b>urea @ 22 kg</b> per 0.15 ha uniformly at the base of each crop plant.	Place <b>urea</b> at a height [from ground level] that will allow it to come into contact with irrigation water, in order to facilitate its effective dissolution, and consequent availability.
20 - 30 DAT	Fertilizer application	<i>After weeding</i> , apply a <b>micronutrient mixture</b> formulation as foliar spray.	This <b>micronutrient fertilization</b> may alleviate deficiencies that may potentially affect crop growth and yield. Apply uniformly. Use <b>safety equipment</b> . Do not apply when windy. Use <b>flat fan type nozzles</b> for spraying. Avoid spraying before impending rain events.
20 - 30 DAT	Irrigation	<i>After fertilization</i> , irrigate the field.	Irrigate <i>lightly</i> if soil moisture is not low.

20 - 30 DAT	Mulching	<p>If off-farm <b>mulch</b> material is used, then, <i>after weeding</i>, cover soil surface with a thick layer of <b>mulch</b> such as <b>rice-straw</b> or <b>arecanut-husk</b>. In case of zero-till production with on-field <b>rice-straw</b> residue, distribute the <b>mulch</b> material in the inter-row spaces of the crop.</p>	<p>Make sure to cover soil surface completely, because gaps in the <b>mulch</b> can lead to weed outbreak. By reducing inter-row tillage, and erosive power of water/wind, and by being a barrier to soil displacement, <b>mulching</b> conserves soil by reducing erosion. Mulching can suppress weed growth, conserve soil moisture, increase soil organic matter and improve overall soil health.</p>
20 DAT - Harvest	Plant protection	<p>If whitefly (<i>ETL 5-10 flies /leaf</i>) or aphids (<i>ETL 30 aphids/ plant</i>) are noticed, spray <b>neem oil @ 150 mL</b> per 0.15 ha @ 75 liters spray volume (i.e. approx. 2 mL per liter of water).</p> <p><u>If pest population is high</u>: Spray [all @ 75 liters spray volume for 0.15 ha];</p> <p><b>Lastraw® @ 375 mL</b> (5 mL per liter of water) 2 - 3 times at weekly intervals   <b>acetamiprid 20 SP</b> formulation @ 75 g (1 g per liter of water) against whitefly   <b>thiamethoxam 25 WG</b> formulation @ 30 g (0.4 g per liter of water) against whitefly   <b>chlorantraniliprole 18.5 SC</b> formulation @ 35 mL (0.5 mL per liter of water) against soft-bodied larvae.</p>	<p>Apply uniformly. Use <b>safety equipment</b>. Do not apply if windy. Use <b>cone-type nozzles</b> for spraying. Avoid spraying before impending rain events. Strictly <b>follow label instructions</b>. Be aware of <b>pre-harvest [residue] intervals</b>, for applications and harvest at proper times. Be aware of <b>field re-entry intervals</b> after application. Make sure to cover underside of leaves. Controlling white flies is also necessary to control yellow mosaic virus, as the former are vectors of this viral disease. Maintain 10 - 15-day intervals between consecutive pesticide [spray] applications.</p>

<p>20 DAT - Harvest</p>	<p>Plant protection</p>	<p>If caterpillars such as diamondback moth, cabbage butterfly or <i>Spodoptera</i> are noticed (<b>ETL 10 larvae/ plant</b>) , spray [<i>all @ 75 liters spray volume per 0.15 ha</i>] <b>neem oil @ 150 mL</b> (2 mL per liter of water); then, approx. 3 days later, spray <b>Beauveria</b> or <b>Metarhizium</b> formulations @ 250 g per 0.15 ha (3 g per liter of water). <u>If pest population is high:</u> Spray [<i>all @ 75 liters spray volume for 0.15 ha</i>]; <b>spinosad 48 SC</b> formulation @ 45 mL (0.6 mL per liter of water)   <b>flubendiamide 48 SC</b> formulation @ 35 mL (0.5 mL per liter of water)   rotate with <b>chlorantraniliprole 18.5 SC</b> formulation @ 35 mL (0.5 mL per liter of water)   <b>emamectin benzoate 5 SG</b> formulation @ 112 g per 0.15 ha @ 75 liters spray volume(1.5 g per liter of water).</p>	<p>Apply uniformly. Use <b>safety equipment</b>. Do not apply if windy. Use <b>cone-type nozzles</b> for spraying. Avoid spraying before impending rain events. Strictly <b>follow label instructions</b>. Be aware of <b>pre-harvest [residue] intervals</b>, for applications and harvest at proper times. Be aware of <b>field re-entry intervals</b> after application. Make sure to cover underside of leaves. Maintain 10 - 15-day intervals between consecutive pesticide [<i>spray</i>] applications.</p>
-------------------------	-------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

<p>20 DAT - Harvest</p>	<p>Plant protection</p>	<p>If alternaria leaf spots, head rot or club root are noticed, spray <b>chlorothalonil 75 WG</b> formulation @ 150 g per 0.15 ha @ 75 liters spray volume (i.e. 2 g per liter of water), or <b>Propineb 70% WP @ 150 g per 0.15 ha @ 75 liters spray volume</b> (i.e. 2 g per liter of water).</p>	<p>Apply uniformly. Use <b>safety equipment</b>. Do not apply if windy. Use <b>cone-type nozzles</b> for spraying. Avoid spraying before impending rain events. Strictly <b>follow label instructions</b>. Be aware of <b>pre-harvest [residue] intervals</b>, for applications and harvest at proper times. Be aware of <b>field re-entry intervals</b> after application. Make sure to cover underside of leaves. Maintain 10 - 15-day intervals between consecutive pesticide [spray] applications.</p>
-----------------------------	-------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

20 DAT - Harvest	Plant protection	<p>As preventative measure against bacterial black rot and bacterial soft rot, drench base of plants with <i>Trichoderma</i> and <i>Pseudomonas</i> formulations @ 10 g per liter of water.</p> <p><u>In case of organic farming:</u> Drench base of plants with a mixture of <b>asafetida @ 75 + turmeric @ 375 g</b> in 750 liters of water per 0.15 ha (i.e. 0.1 g <b>asafetida</b> and 0.5 g <b>turmeric</b> per liter of water).</p> <p>For all, drench @ 200 mL per plant.</p>	<p>Apply uniformly. Use <b>safety equipment</b>. Do not apply if windy. Use <b>cone-type nozzles</b> for spraying. Avoid spraying before impending rain events. Strictly <b>follow label instructions</b>. Be aware of <b>pre-harvest [residue] intervals</b>, for applications and harvest at proper times. Be aware of <b>field re-entry intervals</b> after application. Make sure to cover underside of leaves.</p>
30 - 35 DAT	Weed management	Perform a shallow inter-row <b>weeding</b> operation.	It is best to complete this activity when weeds are small, because they are easier to control at this stage.
30 - 35 DAT	Irrigation	<i>After weeding</i> , irrigate the field.	Irrigate <i>lightly</i> if soil moisture is not low.
-	Harvesting	Harvest heads, along with a few leaves, when they are firm, and of marketable size and quality.	Harvest heads along with a few wrapper leaves for protection.



**Editor**

**Vinay Bhaskar**

**[E-mail: [vinay.bhaskar@worldveg.org](mailto:vinay.bhaskar@worldveg.org)]**

**Contributors**

**IPM: Srinivasan Ramasamy, Paola Sotelo-Cardona**

**Agro-chemicals: Souradeep Acharjee**

**Nursery: Ravishankar Manickam**

**Design**

**Abhilash Miriyapalli**

**For more information, contact:**

**WorldVeg [Guwahati] APART Office  
Strategic International Partnership Center (SIPC)  
5th Floor, Nayantara [supermarket] Building  
Six Mile, Guwahati 781022  
Assam, India**

**World Vegetable Center  
South and Central Asia  
ICRISAT Campus, Patancheru 502324  
Hyderabad, Telangana, India**

**Tel: +91-40-30713071**

**Fax: +91-40-30713074 / 75**

**Email: [info-sca@worldveg.org](mailto:info-sca@worldveg.org)**