Good Agricultural Practice For Vegetable Farming (GAP-VF)

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This document explains the vegetable farm's compliance with the standard of the Good Agricultural Practice for Vegetable Farming (GAP-VF) Certification scheme.

Disclaimer:

This document may be subject to review from time to time as deemed fit by the Singapore Food Agency (SFA)

Code of Practice (COP) - Good Agricultural Practice (GAP-VF) for Safe and Quality Vegetable Farming

The Good Agricultural Practice for Vegetable Farming (GAP-VF) is a set of consolidated practices or COP formulated by Singapore Food Agency (SFA) for on-farm safe and quality vegetable and foodcrop production. This code of practices is based on concept of Hazard Analysis of Critical Control Points (HACCP) and quality management principles with emphasis in the following six key areas:

- Farm location
- Farm structure
- Farm environment (soil/ water)
- Farm maintenance (hygiene and cleanliness)
- Farming practices/ methods/ techniques (pesticide and fertilizer applications, pest and disease management, postharvest handling)
- Farm management (farm records, traceability, staff training)

Vegetable growers must specify the types of vegetables produced from their farms, identify the potential critical hazards and establish and monitor appropriate measures during all phases of farm production. Corrective actions must be established, implemented and documented at the time of hazard occurrence. Establishment of verification procedures and proper documentation (i.e. log records, SOPs, instruction manual, procedures) of such practices are required and be complemented with proper communication and training of staff in good farm practices and management.

The following documented practices form the Code of Practice to be used by farms producing vegetables such as leafy, fruit, head and root vegetables, beansprouts and herbs.

Good Agricultural Practice

Section A

1. FARM LOCATION

1.1 The land must be evaluated to be suitable for agricultural land use. The land is located outside zone for heavy industries. It must not have a history of industrial use.

1.2 An environment impact assessment conducted and preventive or improvement measures introduced by farmers or technical expert will be useful.

2. FARM STRUCTURE

2.1 Vegetables (except in fruit vegetable cultivation) must be grown under protected cultivation (i.e. netted, rain shelter, greenhouse) to provide necessary barriers for effective protection against insects, birds and animals which are possible carriers of biotic pathogens to ensure quality production.

2.2 Cultivation, storage and packing areas must be kept clean and tidy. Litter, waste and weeds must be removed from immediate vicinity of crop production area. Effective measures must be taken to dispose of rubbish heaps (including any waste arising from the harvesting and processing of vegetables) on the farm.

2.3 Irrigation system should be maintained to provide effective delivery, prevent blockage and back siphonage.

2.4 All equipment associated with cultivation, harvesting and storage of vegetables should be well maintained in optimal operating conditions.

2.5 Vegetable growing plots must be clearly demarcated and labelled.

2.6 Clean toilets and hand washing facilities for workers must be provided in the farm.

3. FARM ENVIRONMENT

Soil*

3.1 The soil must not be contaminated with heavy metals (Cadmium, Chromium, Mercury, Lead; See Annex on Lab Analysis). The heavy metals must be analysed every 3 years and the contents must not exceed the safety limits. Upon top-up of soil for cultivation, soil should be re-analysed for heavy metal contamination. The farmer should notify SFA if there is any large scale top-up of soil for cultivation.

3.2 Records of heavy metals testing from accredited laboratory must be kept and produced during audit.

3.3 Records of application of growing substrates (e.g. cocopeat) must be kept and produced during audit. Records must include date of application, type of growing substrate and plots where growing substrate was applied).

Water*

3.4 Pond water used for agricultural purposes (e.g. irrigation of plants or used in pesticide applications) must be of good quality as stated below:

- Pond must not contain litter or weeds.
- Animals, except fish, must be kept away from the pond.
- Runoff from cultivation areas and sewage water must not get into the pond.

4. FARM MAINTENANCE

4.1 Animals should not be allowed into or kept in all cultivated areas, growing houses, storage rooms and packing rooms. Animal proof and adequate pest control measures should also be implemented.

4.2 Packing area/ shed must be cleaned with appropriate cleaning schedules and procedures.

5. FARMING PRACTICES

Use of Pesticides*

5.1 Pesticide usage during vegetable production must comply with SFA legislation, term(s) and condition(s); requirement(s) and any other restriction(s) as set by SFA from time to time.

5.1.1 Only SFA certified pesticide operators are allowed to carry out and supervise pesticide operation in the farm.

5.1.2 Only registered pesticides are to be used.

5.1.3 Dosage of pesticides, time and frequency of pesticide application and type of crop allowed for use of such pesticide must follow according to the recommendations on the manufacturer's label or as directed according to a qualified plant health specialist which SFA recognises or can recognise.

5.1.4 Pesticide operators must be familiar with all aspects on the safe use and application of pesticides.

5.1.5 Pesticides must always be clearly labelled and stored in original container and under lock and key. Warning sign must be displayed at the storage area. Storage area must be isolated from packing areas to prevent contamination from leaching, runoff or wind drift. Good pesticide storage practice should be adhered to, including ensuring that the store has facilities to clean up spills and putting out flames.

5.1.6 Disposal of pesticides containers and unused sprays solutions must be done according to instructions included on the manufacturer's label or in accordance to regulations. No recycling of empty pesticide container for other usage.

5.1.7 Records of purchase, application and disposal (Log records, procedures, or instruction manual, See Annexes) of the pesticides must be kept and produced during farm audit.

5.1.8 Spraying equipment must be well maintained to ensure that the equipment operates at the optimum condition so that right application rates are delivered and unnecessary leakage avoided.

5.1.9 Re-entry interval after pesticides are sprayed should be observed.

5.1.10 Operators must be trained on proper pesticide usage. They should be continually trained to operate and maintain equipment for effective spraying.

5.1.11 Pesticides should not be stored for more than a year before using.

5.1.12 Withholding periods or pre-harvest intervals for pesticides must be strictly observed.

5.1.13 Pesticide spray mixtures of more than 1 insecticide and 1 fungicide must be avoided, unless advised by manufacturer's recommendation or are inherent in a formulation.

Use of Fertilisers*

5.2 Raw manure or human waste must not be used for vegetable cultivation.

5.3 Natural fertilisers such as poultry manure or other organic materials must be fully composted at a stable temperature with no foul smell. Heavy metal analyses should be conducted.

5.4 Direct contact between natural fertilisers and vegetables must be minimised, especially during the last 2 weeks of the crop cycles i.e. about 14 days before harvesting.

5.5 Fertilizers must be stored separately from pesticides in a clean and dry area (preferably slightly elevated above ground on pallets).

5.6 Storage area must be isolated from packing areas to prevent contamination from leaching, runoff or wind drift.

5.7 For hydroponic system, nutrient stock from new purchase/ supplier must be of technical grade and assessed for potential risk of heavy metals contamination.

5.8 Laboratory analysis records must be filed for farm audit, if any.

Use of Other Agrochemicals

5.9 Agrochemicals such as detergents/ disinfectants, sanitizers, plant growth regulators, adjuvants and other additives must be carefully applied as recommended by the manufacturer's label.

5.10 These agrochemicals must be kept in their original packing/bottles or clearly labelled and locked separately from fertilizers and pesticides.

Pest and Disease Management

A pest and disease management programme must be put in place taking into account historical data, trends and current conditions. The programme should embrace 3 basic sequential steps of prevention, observation or monitoring and intervention.

a. Prevention:

All aspects of farm management should be examined for inclusion into a pest management strategy for the purpose of preventing pest infestation.

b. Observation:

The crops are carefully and regularly inspected to determine whether the preventive strategy is adequate.

c. Intervention:

Where the preventive strategy proves inadequate when damage thresholds are exceeded, the choice of intervention should be available. The method chosen must be produce-safe and environmentally friendly.

The pest and disease monitoring system should be able to anticipate pest problems so that preventive measures can be taken. Any disease or pest detected should be closely monitored for progress. Control measures or IPM strategy should be implemented once the threshold for the specific problem is breached.

5.11 An integrated control strategy utilising a combination of physical, biological and chemical preventive control measures must be implemented. Pesticide use should be minimised and a sustainable pesticide use strategy should be employed to prolong the use of effective pesticides.

5.12 The protected cultivation enclosure must be maintained to prevent the entry of pests, at all times.

5.13 Any new or unusual pest, disease or symptoms out of the norm should be diagnosed, identified or advice to be sought from expert.

5.14 All pest and disease management processes should be documented. Emergency plans for pest and disease outbreaks should be prepared.

5.15 Diseased plants and plant waste must be removed from the farm immediately with documented procedures. Care must be taken to ensure that disease and pests are not spread within the farm by movement of people and equipment.

5.16 Crop rotation and regular weed control should be practised.

5.17 Equipment (cultivators, pruners, cutters etc) used within the diseased plots should be cleaned and sterilised where necessary (e.g. with 10% sodium hypochlorite or heat treated) on a regular basis before being used again especially in healthy plots.

5.18 Staff should be continually trained and be equipped with a knowledge to understand and identify the main pests and the measures to control them.

Harvesting

5.19 Harvesting must be rapid and must minimize damage and contamination of the vegetables as well as the receptacles used for harvesting with soil, compost, microbial pathogens, fertilizers, pesticides chemicals, etc. and any potential contaminant sources (e.g. chemicals, microbial pathogens, etc).

5.20 Harvested vegetables should be pre-cooled quickly (immediately within the shortest time brought to the shade out of direct sunlight).

5.21 Harvested vegetables which can be ready-to-eat (eg lettuce, tomatoes, etc) must undergo a washing process with potable water to thoroughly remove any surface contaminants.

5.22 Washing facilities for vegetables must be self-contained and under shelter from the weather elements.

5.23 Water used for washing of vegetables prior to packing must be free from pathogenic microbial contamination following the recommended measures:

- 5.23.1 Only clean water (i.e approved quality, checked by lab analysis for E.coli, See Annex on Lab Analysis) is used for washing the vegetables
- 5.23.2 frequent change of water for washing and/or
- 5.23.3 disinfectants or sanitizers used, if needed, is based on the recommended dosage according to manufacturer's label.

5.24 Vegetable surfaces should be dry before packing.

Packaging

5.25 Packers must wash their hands with detergents before and after handling vegetables.

5.26 Packers must not smoke, drink or eat when packing the vegetables as they may introduce microbes from their mouths. They should wear rubber gloves and apron during packing operation.

5.27 Packing line and machines must be washed and disinfected regularly before and after packing according to instruction manual/ procedures.

5.28 Packing containers/ crates should be sanitized according to instruction manual/ procedures prior to the use for packing of vegetables.

5.29 Packing containers/ crates containing harvested vegetable must be raised on pallet and covered, if left over-night outside the coldroom, to avoid contamination, wetting by rain and kept in a separate area well away from contaminating agents such as pesticides or fertilizers.

5.30 Packing room must be separated from toilet facilities and must be kept clean, tidy, well ventilated and free of foul smell at all times.

5.31 Packed vegetables must be free from soil, trimmed to ensure that only clean vegetables are packed and dispatched.

5.32 All vegetables if retail packed, must be packed in clean, new single-use plastic bags. Packing materials such as plastic bags must be kept away from rodents, birds, farm animals and physical and chemical hazards.

5.33 Vegetables should be retail-packed (or bulk packed) and sealed on the farm. Each pack must be clearly labelled with the farm's name according to the labelling regulation and the certification *Mark* (also applicable to certified farm seeking for renewal). A farm that packs vegetables produced from various sources must have proper documentation (SOPs and work instructions) with crates properly labeled to ensure traceability back to source farm(s), a proper sanitization program approved by SFA as well as segregated packing system (timing/line/areas) for the farm's own produce vegetables and vegetables produced from other farm(s) to prevent cross contamination.

Cold Storage

5.34 Storage facility must be sanitized and cleaned, and free from decaying plant wastes and foul smell.

5.35 Vegetables should be stored in the cold room immediately after packing. Refrigeration equipment should be in good working condition with regular temperature check and records. Storage in cool room is recommended at the temperature of 5-10^{0}C with 95-99% relative humidity.

6. FARM MANAGEMENT

Farm records

6.1 The farm must identify a co-ordinator to deal with matters associated with GAP-VF certification.

6.2 All farm records (inputs purchases, log records e.g production, SOPs, instruction manual, procedures, laboratory tests, pesticide operator certificate, corrective action(s) taken and updated) required under the GAP-VF certification must be up-to-date (See Annexes).

6.3 Updated records must be kept for up to two years. New farm applying for certification must have 3 months of farm records.

6.4 Copies of laboratory analysis and certificates that verify compliance with SFA's regulations must be filed.

Traceability

6.5 Each package/ bulk packed produce leaving the farm must be traceable (e.g. tag with GAP-VF Certification Number or farm's name, date of harvest) to farm/ source.

6.6 Records of a lot number must be maintained for all produce leaving the farm.

6.7 Recall procedures for produce, in case of non-compliant to GAP-VF standard, must be in place and undertaken by the farmer.

Staff Training

6.8 Farm must help its workers to understand and follow the Code of Good Agricultural Practices by circulating circulars, updates and/or holding briefings for its workers.

6.9 Continued training on pesticide operation, pest and disease management, basic personal hygiene and farm safety should be conducted. Staff training records must be maintained.

(* refers to the Critical Control Area at which potential hazards may occur)

Good Agricultural Practices depicted in Section A is documented mainly for farms producing mainly leafy, head, fruit and root vegetables and herbs.

Additional Good Agricultural Practices, as depicted in Section B, are mainly for farms producing vegetables intended for use as salad (i.e. lettuce, tomatoes, herbs and sprouts) or largely beansprouts. These practices for preventing microbial contamination (See Annex on Lab Analysis) must be strictly observed.

SECTION B

Section B depicts additional practices for beansprouts producing farms with emphasis on measures to be taken against microbial and agrochemical contamination.

1. SEEDS

1.1 Seeds for beansprouts production should be tested for purity and germination rate.

1.2 Seeds must be stored under conditions that will protect against microbial contamination or contamination by rodents and prevent deterioration.

1.3 Seeds must be tested free from microbial contamination (See Annex on Lab Analysis) and decontamination prior to sprouting. Microbial decontamination treatments must be conducted according to recommendations on manufacturer's label.

2. WATER

2.1 Water for seed soaking and washing and irrigation must be potable.

2.2 Before disposal, waste water from beansprout production must meet NEA’s requirements (e.g. BOD).

3. AGROCHEMICALS

3.1 Agrochemicals such as detergents/ disinfectants and sanitizers, plant growth regulators (e.g. 2,4-D or 6-BA), adjuvants and other additives to be used must be approved by SFA and are applied as recommended on the manufacturer’s label.

3.2 These agrochemicals are kept in their original packing/ bottles or clearly labeled and locked separately from fertilizers and pesticides.

3.3 Seeds soaking in chlorinated water should be shorter than 12 hours.

ANNEXES

LABORATORY ANALYSIS

1. List of microbial contamination agents in fresh produce

- *E. coli 0157:H7*
- *Cyclospora*
- *Listera moncytogenes*
- *Samonella enteritis*

1.1 Microbial analysis is available at SFA:

10, Perahu Road, S718837,
Fax: (065) 68619491
Tel : (065) 67952822, 67952829

(Tests conducted by other international accreditated laboratories are accepted for evaluation)

2. List of contaminating heavy metals

- Cadmium, Cd
- Lead, Pb
- Mercury, Hg
- Chromium, Cr

3. Water Quality Test

Clean water must be used on the farm for vegetable cultivation. WHO has a standard for "acceptably clean" irrigation water (i.e <=1000cfu per 100ml. cfu stands for colony forming units and <= 20 cfu. gram of strains of *E. coli* which caused food-borned illness). Microbial test of water sample can be conducted at SFA. Potable or clean water must be used for washing of vegetables. Treated water, with sanitizers, should not contain microbial contaminants exceeding the permitted level.

Documents/ test results (from SFA or internationally accredited laboratory) on the above listed items to prove farm's compliance must be made available at time of farm audit and inspection.

USEFUL REFERENCES

1. *Code of Practice for Minimally Processed Ready-to-Eat Vegetables*, Canadian Food Inspection Agency (http://www.inspection.gc.ca/english/plaveg/fresh/read-eat_e.shtml)

2. *EUREPGAP*, EUREP EuroHandelsinstit e. V.(HI), Cologune (http://www.eurep.org/sites/index_e.html)

3. *SQF program* (http://www.sqf.wa.gov.au/services/hnews.html).

4. *Food Safety Begins on Farm - A Grower's Guide - Good Agricultural Practices for Fresh Fruits and Vegetables*, Anusuya Rangaranjan, Elizabeth A. Bihn, Robert B. Gravani, Donna L. Scott, and Martvin P. Pritts.

5. *Best Practices Field Cored Lettuce "FC Lettuce"*, United Fresh Fruit & Vegetable Association , National Food Processors Association, NFPA.

6. *FDA Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetable* (http://vm.cfsan.fda.gov/~dms/prodguid.html)

7. *Codex Standards for Fresh Fruit and vegetables* (http://www.codexalimentarius.net/search/search.jsp?lang=en)