RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security

Table 1. General Recommendations and Experiences of My Loi CSV Farmers and Ha Tinh Agricultural Staff during ACIS Project from 2015-2018

Crop selection, timing, and management	In case of... Drought SPRING-SUMMER	Hot spell SPRING-SUMMER	Heavy rain, flooding, storm AUTUMN	Cold spell/ frost WINTER
Crop selection (for specific crops, see Table 2)	• Drought-tolerant crop varieties or species, such as beans, sesame, rice P6, and Khang dan 18 • Most sensitive crops: rice, sweet potato, maize, and water melon	• Heat-tolerant crop varieties or species, such as sesame and watermelon • Most sensitive crops: rice, sweet potato, and maize	• Short-term varieties or species: 90- to 110-day rice (Khang dan 18, Xuan Mai, HT1) and beans • Storm-tolerant crop: tea • Most sensitive crops: peanut, tea, and cassava are sensitive to flooding/ flash flood; banana, acacia, eucalyptus, and agarwood are sensitive to strong wind and storm	• Cold spell-tolerant varieties or species, such as rice (N98, Xi23) and winter vegetables (i.e., onion, lettuce, long bean, and bok choy) • Most sensitive crops: rice, maize, and pepper
Farming calendar	• Plant annual crop as soon as possible after harvesting previous crop to utilize remaining soil moisture • Minimum or no-tillage	• Adjust sowing, transplanting, and planting dates to avoid planting crops during the hot period	• Avoid planting crops when soil is too wet • Adjust sowing, transplanting, and planting dates to avoid flowering stage and harvesting stages during heavy rain period since flowers can be fallen and no pollination occurs if flooding or storm happens • Consider harvesting early, if flooding or storm is forecasted near harvest time	• Adjust (postpone or advance) sowing, transplanting, and planting dates to avoid planting during cold spell period
Management	• Harvest water in water reservoirs, ponds, and ditches • Irrigate early in the morning or late afternoon to reduce evaporation • Use drip irrigation for pepper, orange, or fruit trees when water resources are limited	• Trees provide shade that regulates micro-climate and minimizes the peak temperature for crops and animals • Shade trees with dense canopies (i.e., *Chukrasia tabularis*, *Erythrophleum fordii*) and fruit trees (i.e., citrus, longan,and guava) are good for some shade-tolerant crops such as amomum, ginger, lemon grass, taro, and turmeric crops • Trees with light canopies, such as cassia tree (*Senna siamea*) and coffee senna (*Senna occidentalis*) are good in tea plantations • Grow ginger in bags under shade • Mulch crops • Monitor maximum temperatures to take action, such as watering animals or cooling pig sties with fan • Temperatures are at the highest around 1-2 PM; keep people and animals under shade	• Keep seeds dry • Clear ditches provide good drainage • Reduce damage from falling tree parts: prune trees, cut damaged branches, and thin out leaves • Stabilize plants, the exposed roots portion of the plant should be potted with soil • Use supporting trees or pillars to firm up sensitive plants (e.g., sugarcane) • Plant wind shields to reduce wind damage on crops (e.g., bamboo shields) • Countour planting and grass/pineapple strips on soils prone to topsoil and gully erosion. • Move animals to safe high lying place.	• Cover seedlings with rice husks, rice straw, and/or dry leaves (or plastic) • Add ash or mulch with rice husk to maintain higher soil temperature • Irrigate in the morning to remove frost on crop leaves • Monitor minimum temperatures to take action (especially cover seedlings and feeding and shelter livestock) • Keep livestock indoors
	• Add (vermi)compost before planting crops and trees • Mulch topsoil (trees, ginger, pepper, and/or local taro) with rice straw, palm, and crop leaves • Plant cover crops (Guinea grass, *arachis pintoi*, and seasonal vegetables between rows of trees) • Plant shade trees for shade-tolerant crop (e.g., for pepper and tea)		• Store winter feed for livestock: dried rice straw, corn, and/or corn husk	
	• Prepare seed to replant in advance • Intercrop (peanut+ cassava, sweet potato + maize) and no/minimum tillage to minimize soil evaporation and soil erosion, and to reduce weeds • Diversify crops to reduce the risk of losing all crop products • Rotate crops to reduce transmission of pests and diseases from previous crop cycle		• Adopt agroforestry by planting annual crops (e.g., leguminous crops, vegetables, ginger, and turmeric) with fruit trees (e.g., citrus, guava, longan, among others) to reduce evaporation, soil erosion, and weeds, and to provide shade and wind protection, and nitrogen-fixing species that improve soil fertility • Follow seasonal and daily weather forecasts to plan crop stage with the most likely rain and temperature forecast for the season, and to decide on agricultural activities, e.g., spraying and adding fertilizer • Regularly check livestock health, sanitize livestock shelter and pig sty	
General crop management	• Fertilizer/manure: - Add compost (mix of crop residue and livestock manure) to improve soil organic matter, as well as soil water holding capacity - Add lime into the soil to remove dormant pests and diseases from previous season and to control soil pH - Apply chemical fertilizer in the late afternoon to reduce Nitrogen volatilization - Do not apply nitrogen when crops are infected by pests and diseases - Do not apply fertilizer if it is going to rainheavily or if the weather is too hot or dry for more than three days already • Pests and diseases management: - Regularly check on the fields to identify pests and diseases problems as soon as possible , from 1-3 times per week during sensitive growth stages such as panicle stage of rice/vegetative growth of fruit trees, flowering and fruiting stages of trees/crops as well as during drought, high/ low temperature and high humidity periods. - Manually collect and destroy caterpillars/larvae observed in the field in the dusk hours		- Use bio-pesticide made from garlic, ginger, and alcohol to control certain types of leaf-damaging pests, such as caterpillars, rice leaf folder, and leaf-eating worms - Do not kill or use chemical substances on pollinators such as: ladybugs which eat aphids, scale insects, mealybugs, and whiteflies; laybird beetle and yellow ants which eat aphids; spiders which eat insects; dragon fly which eat insects, larvae and bees - Install fruit fly pheromone traps for fruit trees - Use lamp near fish pond to attract insects (for fish feed) - Avoid using chemical pesticides unless necessary. Read instructions on pesticide container label carefully before use. Follow instruction on 4 rights: right time, right type, right dose, and right way. Use protection when spraying. Do not clean the equipment near wells. - Spray operations should be conducted on cool and calm day (not in direct sunshine or before rainfall). Spray should be conducted in the wind direction • Irrigation: - Irrigate crops in early morning or late afternoon to avoid stressing plants with rapid change in soil temperature	
Some other references	Weather forecast: https://www.windy.com Seed varieties: http://hatinhseed.com/m/?x=4/san-pham/giong-lua-truyen-thong Farmers' ranking of tree suitablity with extreme weather events (table 3)		Agricultural advisories - Ky Anh district: http://kyanh.hatinh.gov.vn/kyanh/portal/folder/thong-tin-ve-nong-nghiep - Ha Tinh province http://sonongnghiep.hatinh.gov.vn/category29/Sau-benh-dich-benh.htm - Ha Tinh Farmers' Association: http://hoinongdanhatinh.vn/vi/news/Nha-nong-can-biet/	

Shade trees with dense canopies

Trees with light canopies

Table 2. Recommendations for Specific Faming Systems - Collection of Experience of My Loi CSV Farmers and Ha Tinh Agricultural Staff during ACIS Project from 2015-2018

Farming practices	In case of... Drought SPRING-SUMMER	Hot spell SPRING-SUMMER	Heavy rain, flooding, storm AUTUMN	Cold spell WINTER
Rice	• Use short-term and drought-tolerant rice variety • Irrigate		• Plant or sow seeds as early as possible to harvest before storm period • Harvest early if required	• Add ash or mulch with rice husk on topsoil, to maintain soil temperature
Bean or Cassava intercropped with peanut-bean and/or maize in rotation	• After peanut harvest, plant bean while soil remains moist from previous crop		• Plant beans in time to harvest before the heavy rains start • Prevent rotting disease e.g., *rhizoctonia solani* in peanut: add lime before rains and on a sunny day after 3-4 days of continuous light rain. Hill up plants and provide good drainage • Remove infected plants, add lime on the soil to kill fungus	• Add ash or mulch with rice husk and cover topsoil, to maintain soil temperature
Maize intercropped with sweet potato	• Avoid planting when soil is crust and temperature is too high (38-40°C for 3 days continuously) • Irrigate		• Adjust farming calendar to avoid planting during heavy rain, flooding and storm conditions • Clear ditches for good drainage	• Add ash or mulch with rice husk to maintain soil temperature
Black pepper with Mac tree (*Wrightia annamensis*)	• Mulch with rice straw, palm leaves or another crop residue • Drip irrigation	• Cover the soil around young pepper seedlings (1-2-year-old) with palm leaves • Use live supporting trees (e.g., Mac tree) for pepper instead of cement pillars to create micro-climate temperature under trees and reduce heat during hot spells period. Cementitious materials absorb heat and drain quickly, making the column hot and dry (up to 45°Cduring the dry season)	• Prevent rotting diseases: prune branches, runner shoots, and leaves near the soil, drain rootsbranches should be at 10-15cm from topsoil; remove dead and sickplants; add lime (see cassava-peanut) to avoid *Phytophthora* fungus and nematodes, which may cause roots toroot- rot, and quick or slow wilt diseases on pepper	• Irrigate in the morning to avoid frost damage, if possible • Plant wind shield trees, e.g., bamboo and jackfruit trees can minimize cold humid wind directly on the pepper plant
Orange and pomelo-based systems	• Suitable cover crops: legumes, vegetables, Arachis pintoi • Mulch with straw or palm leaves • Drip irrigation • Water harvesting pond	• Cover the soil around young trees and seedlings with palm leaves as mulch	• Ensure well-drained soil • Remove broken and shooting branches • Prepare terraces for fruit crops (e.g., citrus, guava, and banana) on steep slopes to prevent nutrient and top soil losses due to heavy rain • Plant strips of grass or pineapple to prevent soil loss	• Irrigate in the morning to avoid frost damage • Spray flower stimulants to stimulate timing of orange flower (ask extension for advice)
Tea	• Plant shade tree (*Senna siamia*) • Intercrop tea with maize in the first year • Mulch with rice straw and leguminous residue		• Drain well • Prune trees before	• Irrigate in the morning to avoid frost damage, if possible
Livestock	• Water livestock; during hot spells, a cow can consume up to 100-150 liters per day • Shower pigs and cattle • Regularly check livestock health, sanitize livestock shelter and pit sties • Check for scheduled disease vaccination of livestock/poultry, such as bovine respiratory disease and foot-and-mouth disease. Follow veterinarian advice. Avoid over consumption of antibiotics • Ensure good air circulation or put a fan in the pig sty. Connect fan with solar power to minize cost		• Move livestock to safe high-lying place	• Store feed for livestock • Supplement fermented feed to cattle • Keep livestock indoors • Add rice husk or rice straw to floor to keep livestock warm

Table 3: Tree suitability with extreme weather events. Ranking by 9 villages in Ha Tinh province but not all trees/crops and extreme weather events are mentioned in all villages. Source: Simelton et al, 2012

	Tree/crop	Cold spell	Hot spell	Drought	Flooding	Storm	Flash flood	Early rain	Late rain	Salinity	Number of villages
Staple crops	Rice										9
	Sweet potato										7
	Maize										6
	Cassava										5
Forestry	Eucalyptus										8
	Melia										5
	Casuarina										7
	Acacia										8
	Bamboo										2
	Mango-pine										2
	Mangrove										2
	Agarwood										1
Fruit trees	Lemon										8
	Orange										8
	Banana										6
	Star fruit										6
	Guava										5
	Jackfruit										5
	Longan										5
	Mango										5
	Pomelo										2
	Mandarine										1
	Star apple										1
Cash crop and intercropping	Peanut										8
	Soybean										4
	Mungbean										3
	Black pepper										3
	Sesame										3
	Tea										3
	Pineapple										2
	Acacia (*)										1
	Manglietia conifera(*)										1

(*): Intercropping with cassava in the first year

Colour codes: very suitable; suitable; not affected; unsuitable; badly affected