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Project TAP–5: The Collaborative Breeding of Five Tropically Adapted Potato Varieties

Annual Progress Report (2019)

January 2020

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ACRONYMS

BW	Bacterial wilt
CIP	International Potato Center
DCP	Department of Crop Production
DM	Dry matter
DUS	Distinctness, uniformity and stability
ELISA	Enzyme-linked immunosorbent assay
HZPC	HZPC Holding B.V.
LB	Late blight
PVFC	Potato, Vegetable and Flower Research Center
PVX	Potato virus X
PVY	Potato virus Y
PLRV	Potato leafroll virus
RRD	Red River Delta
SFSA	Syngenta Foundation for Sustainable Agriculture
TAP	Tropically adapted potatoes
TS	True seed
VCU	Value for cultivation and use

1. PROJECT OVERVIEW

Project Name: TAP-5: The Collaborative Breeding of Five Tropically Adapted Potato (TAP) Varieties

Project Goal: To increase potato productivity, stability, and competitiveness and enhance food security and family income of resource-poor farmers of Southeast Asia.

Collaborating Partners: International Potato Center (CIP), HZPC Holding B.V. (HZPC), and Syngenta Foundation for Sustainable Agriculture (SFSA)

CIP Program Alignment: Through its strategic programme, Agile Potato for Asia, CIP aims to improve systems productivity and farm incomes of at least 7m households in targeted Asian countries over the next 10 years. These improvements will be achieved through development and use of early-maturing agile potato varieties that will contribute to enhancing food security and providing reliable sources of equitable income from ware and seed potato value chains.

Shared Institutional Goal: To enhance effectiveness and impact from breeding by combining strengths of the public and private sector.

Executive Summary: The TAP-5 project was initiated in 2016 to develop region-specific table and processing varieties for tropical agro-ecologies of Asia. The potato production in the continent is highly diverse, ranging from globally potato-producing leading countries like China and India to countries of South-east Asia with lowest potato consumption. Despite this contrast, challenges of potato production are similar across the continent.

The region is characterised by large population of smallholder farmers who are cultivating potatoes in biotic- and abiotic-stressed areas with limited or no access to quality planting material. The project is formulated with an aim to ensure timely availability of superior quality seed of the developed varieties to the potato farmers in the region. Under the collaborative effort, so far four sets of true potato seed families developed from HZPC and CIP germplasm have been received in Vietnam.

These sets are being evaluated at different stages in lowlands and highlands of Vietnam. Field trials are being carried out in lowlands in the Red River Delta (RRD) and highlands in Dalat at different stages. In lowlands, 17 clones from set 2 at F_1C_2, 16 clones from set 3 at F_1C_2, and 6 clones from set 3 at F_1C_3 stage were selected, which are under further evaluation during current season. In highlands 14 clones from merged set 1 and set 2 group at F_1C_4 stage, 8 from set 3 at F_1C_3 stage, and 368 clones from set 4 at F_1C_1 stage were selected in December 2019. Eighteen clones from transferred selections of set 2 from lowlands are under evaluation at F_1C_3 stage in midlands (900 masl), near Dalat airport. These clones are current selections based on phenotypic recurrent selections combined with processing traits and disease-tolerant ability confirmed from field trials and lab analysis. Performance of the clones under studies are being compared statistically with respective local checks in highlands (PO3 and O7) and lowlands ('Marabel' and 'Solara') for fresh market, whereas with variety 'Atlantic' for processing in both the altitudes.

New population comprising sources of bacterial wilt (BW) resistance from CIP germplasm have been developed in Peru in 2019, which will be transferred to Vietnam in 2020. Two sets of DNA extracts were sent to HZPC during 2019 for testing disease resistance and identification markers for true to type, of which the analysis of one set has been received. The second set was sent in December and results should be available in January 2020. Following-up on the discussion of stakeholders' meeting

in Dalat in February 2019, 11 clones from most advanced populations have been shortlisted for highlands and lowlands and further classified for processing and table sectors. A selected set from shortlisted clones will be exported to India and Indonesia in Asia and Kenya or Tanzania to Africa. A timeline has been drafted for product launching in these countries, which will be presented and discussed in the annual meeting in 2020. The involved team from SFSA, HZPC, and CIP is compiling information and documentation requirements of the targeted countries for germplasm export and variety release processes.

To meet the national requirements for registration and protection of variety, the tubers of the shortlisted clones will be made available to the local authority in Vietnam for distinctness, uniformity, and stability (DUS) testing and value for cultivation and use (VCU) testing. For export purposes, local evaluation, and seed multiplication purposes, all the 11 clones were tested for six viruses locally by using enzyme-linked immunosorbent assay (ELISA) kits imported from CIP–Lima. The team has approached FERA in the UK for further testing of some other viruses and bacteria (eg, clavibacter, Ralstonia, etc.) to minimise the risk of exporting contaminated material. In 2019 a continuous discussion was going on year-round through skype and personal meetings among stakeholders from SFSA, HZPC, and CIP. Marketing experts on the team are drafting the product launching plan in discussion with the other team members and will discuss the plan in detail during annual review meeting. The project has arrived at a junction, where activities have become multidirectional covering field trials, testing of disease status of the elite material, efforts on germplasm export and variety registration, and collection of market information.

2. PROGRESS ON TAP-5 PROJECT THROUGH 2019

The present report covers activities carried out between **January and December 2019.** Previous status of the project is available in the annual reports submitted already.

2.1 GENETICS

2.1.1 Development of BW-resistant population

BW is a serious threat not only in Vietnam but other countries of South-east Asia and Africa. The problem is increasing very fast through infected seed and soil. There is no assured chemical control of the disease, and development of clones which are tolerant or resistant can provide a solution for this increasing problem. In the TAP-5 midterm review meeting that was organised alongside the World Potato Congress in Cusco, Peru, in May 2018, the generation of a new, BW-resistant population was proposed.

The crossing programme was carried out by using CIP parents as female (Annex 1) and HZPC parents as male (Annex 2) at Huancayo (central highlands of Peru, 3,200 masl) from May to November 2019. The programme involved 17 elite lines from HZPC and 7 clones from CIP. HZPC progenitors possess resistance to potato virus Y (PVY), late blight (LB), and nematode resistant with good tuber appearance, processing quality, and high yield. Female parents from CIP, composed of 7 BW-resistant pre-breeding lines derived from resistance sources of crop wild relatives species of *S. commersonii* and advanced LB-resistant CIP breeding material, developed by the Instituto Nacional de Investigación Agropecuaria–Uruguay. These were introduced to the CIP genebank for inclusion in the multilateral system for benefit-sharing using the standard material transfer agreement.

Twenty-seven plants of each female parent were planted in May 2019, and pollination started the first week of August 2019. Pollen of the selected HZPC parents were sent from Holland to Lima, two small plastic micro-vials with pollen of each male parent were received in August. More than 6,160 single flowers were pollinated and only 17% were successful to generate fruits (1,026); 37,264 seeds from 49 families were obtained (Annex 3). The number of seeds per family range from 1 to more than 5,000 seeds, from which 25 families have more than 50 seeds. Pollen of the 4 male parents MERIDA, HOM 15-7266, HZD 08-1059, and HOM 13-8226 were the most successful, showing good viability and producing fruits with good amount of seeds. Most of the male parents produced little or no seed because some showed little or no viability of pollen. The cross combinations of most male parents were not successful, although it somehow also showed that longevity of pollen viability is clone-specific. A loss of viability,, however, could have occurred by delayed and the long trip and receiving process at Lima. It is important to explore the possibilities of how we can further improve the shipment and reduce times to use pollen with good viability.

2.2.2 Clonal selection in Vietnam

Background. New germplasm was developed by conducting a large crossing programme in CIP's screenhouses at La Molina, Lima. Shipped pollen from HZPC was used on the female parents sourced from CIP elite stock. Crossing was carried out in three seasons spreading over 2015, 2016, and 2018. A set of common parents was used during 2015 and 2016; whereas another set involving different parents was used in 2018. Till July 2019 four sets consisting of approximately 200 true seed (TS) families developed by involving 30 clones from CIP and 9 clones from HZPC have been received in Vietnam. Shipment of first two sets arrived at 1 month's interval in 2016, a third set in April 2017, and a fourth in August 2018. DNA of the progenitors was exchanged between the participating organisations.

Molecular analysis of CIP parents was done in HZPC laboratories, and the results are being used for the progeny selections. All the received true potato seed lots are being evaluated under different schemes and are at different stages. Criteria of the selections are tuber- and yield-related traits, disease-resistance ability in field conditions and through DNA analysis, processing traits, and earliness. A defined protocol and selection criteria developed by the team have been followed for raising and screening the clones. Additionally, national protocol of Vietnam has been integrated into the already developed protocol to collect the data according to the local requirements.

Sets 1 and 2 received at 1 month's intervals in 2016 have been merged subsequently into one set in highlands. They were evaluated at the most advanced stage (F_1C_4) in December with 14 selections identified for lowlands and midlands for processing and table purpose (Annexes 4–6). Seventeen clones from set 2 have been selected under lowlands at F_1C_2 stage. Eighteen clones from set 2 are under field evaluation at midlands (900 masl) at F_1C_3. Set 3 from same families received in 2017 are at F_1C_3 stage in lowland at 16 clones, whereas 8 clones were selected from F_1C_3 stage in highlands in recently harvested trials (Annex 7). A total of 3,590 selections were made in February 2019 from seedlings under disease-free conditions in screenhouse from TS set of 83 families, received latest in August 2018. The selected clones of these TS families were planted in a Potato, Vegetable and Flower Research Center (PVFC) field with one clean copy of each selection in screenhouse. During December 2019, 368 clones were selected combining field and screenhouse evaluations (Annex 8).

List of shortlisted clones

Eleven clones have been shortlisted for highlands and lowlands from the most advanced tested population (Annex 9). Owing to a greater number of phenotypic recurrent selections happened in

highlands, more clones were identified for higher altitudes. Eight out of 11 clones were identified for highlands, of which 5 are for fresh and 3 are for processing. Two advanced CIP clones were also part of these selections across both the sectors. For lowlands two clones were shortlisted for fresh sector. Owing to less dry matter (DM) content and deficiency of other processing-related traits, no clone could be identified for processing markets. There are some promising clones in early generations for processing sector, but these need more validation.

Three clones performed better across both altitudes for fresh market. Two of these clones were already in the lowland-selected group. Shortlisting of clones was done based on the comparative comprehensive performance against the local checks by adapting developed and agreed product profile. The criteria also included local challenges in terms of biotic stresses, which are a major concern in South-east Asia. Processing local check ('Atlantic') lacks tolerance to major biotic stresses and performs well only under fully favourable field conditions. Clone HCIP316079.206, which was selected under processing segment, produced good DM, chipping quality, and French frying ability and showed excellent yielding capacity. Among the whole selected lot, this clone has shown best LB resistance. On the other hand, HCIP316027.101 and HCIP316069.204 produced significantly higher yield than the local checks O7 and PO3 under highland conditions, with appreciable amount of LB resistance.

All the three check varieties could not sustain LB incidence; 'Atlantic' collapsed completely and PO3 showed little tolerance. Three clones were selected for both lowlands and highlands for fresh consumption. Among these, HCIP316140.214 showed moderate tolerance to LB under highlands conditions. The clone produced higher yield over both the checks. The checks of lowlands (except 'Atlantic' in highlands) ('Solara' and 'Marabel') were not exposed to LB in the trials, but based on their historical performance over the period they have shown poor to moderate resistance.

Scheme-wise progress based on field trials

Scheme 1 and 2 consisting of sets 1 and 2

- The schemes comprise evaluation of sets 1 and 2, which were received at 1-month's interval through two different shipments. First evaluation was done in highlands for set 1 and lowlands for set 2. A set of tubers from selections of set 2 was transferred to highlands for their evaluation in September 2017 under high altitudes, where selections from set 1 were already available. These two sets were merged and are now at most advanced stage: F_1C_4 under one group with 14 selections.
- The selected clones from set 2 under lowlands are being evaluated at F_1C_3 stage in RRD, where potato can be cultivated only once in year. Another set of selected clones at F_1C_1 stage from set 2 in RRD was also transferred to highlands and evaluated in September 2018 to test their adaptability. This group is currently being evaluated at F_1C_3 stage in Dalat with 18 clones. The trial is in the field and will be harvested in February 2020. In lowlands set 2 is under evaluation at F_1C_3 stage with 17 clones in the field under replicated trials, selected from 51 clones in February 2019. Other than this, the group of most advanced clones of Dalat was evaluated in February 2019 in Hai Phong, RRD; 6 clones were selected. These 6 clones are now being evaluated in Hai Phong, RRD during the current season under farmer field conditions.

Results of the trials conducted during 2019 from the clones received under sets 1 and 2 are:

Hai Phong

1. Eight clones with sufficient tubers out of 23 advanced clones evaluated in Dalat during June 2018 were tested under lowland conditions from November 2018 to February 2019. Seven out of these 8 were tested under replicated trials, whereas clone HCIP316136.101 could not be replicated due

to a smaller number of the tubers. Six clones (ie, HCIP316056.103, HCIP316069.204, HCIP316132.106, HCIP316136.101, HCIP316140.210, and HCIP316140.214) were preferred based on their overall performance (Annexes 10–13). Clone HCIP316056.103 produced yields (47.1 t/ha) higher than all the three checks—namely 'Atlantic' (35.6 t/ha), 'Marabel' (35.9 t/ha), and 'Solara' (42.4 t/ha). The same clone also produced higher tuber DM (22.2%) than 'Marabel' (19.3%) and 'Solara' (21.0%). If compared with 'Atlantic' based on DM and total yield, this clone looks promising. For confirmed comparison, all of these clones are under evaluation in the current season from November 2019 to February 2020 again.

2. Fifty-one clones selected from set 2 in February 2018 were evaluated in Hai Phong from November 2018 to February 2019 in replicated trials at F_1C_2 stage. Seventeen clones were selected based on their performances in the individual replications, and later were combined into one group (Annexes 14–17). As the final harvesting data were collected based on their performance in individual plots, so no statistical analysis was carried out and only average performance was calculated. Sixteen clones were selected for combining yield and appearance performance, and 1 clone (HCIP 316140.214) was retained based on tuber appearance. Some clones—HCIP316056.205 (93.0 t/ha), HCIP316140.203 (68.4 t/ha), and HCIP316040.204 (67.5 t/ha)—produced very high yields. Nevertheless, none of these clones could match the DM produced by 'Atlantic' (23.3%). Clones HCIP316144.108 (52.8 t/ha and 20.7%) and HCIP316056.205 (93.0 t/ha and 19.5%) produced higher yield combined with better DM. The selected clones are being tested in replicated trials from November 2019 to February 2020 in lowlands.
3. Two trials deviating from regular planting time were planted in Chuong My, RRD. The aim was to check the performance of advanced clones from sets 1 and 2 under high-temperature conditions (abiotic stress). The clones with available extra tubers have been planted in these trials. First replicated trial with eight clones was done on October 13th, 1 month sooner than the normal planting time of mid-November. Second planting was done on December 18th with five clones replicated three times having five tubers per replication (Annex 18). The trial also provided seed treatments in the replicated trials, whereas some extra tubers planted in non-experimental areas were not treated to check the effect of seed treatment. The clones will be harvested in mid-January 2020 for early planting and in mid-March 2020 for late planting.

Dalat

1. Fifteen clones at F_1C_3 stage from November 2018 to February 2019 were evaluated in Dalat. Under this trial 14 most advanced TAP-5 clones were evaluated in replicated trials, along with 3 CIP clones. One clone, HCIP316078.106, was planted in screenhouse due to a smaller number of tubers. Except for HCIP316163.101, all TAP and CIP clones were retained for further evaluation. Data were collected on the selected clones and analysed statistically (Annexes 19–22). All the clones produced more yield than the check cultivars 'Atlantic' and PO3. Six clones produced statistically significantly higher yield (more than 47.4 t/ha) than the best yielder, check variety O7. All clones having enough tubers for processing traits were tested for DM, reducing sugar, chips colour, French fry ability, and boiling. None of the clones could surpass best check 'Atlantic' in terms of DM (23.9%), chipping (1.21), and French fry ability (1.21). Clones CIP314953.2 (23.6%) and HCIP 316079.206 (22.8%) were closer to 'Atlantic' in DM. For chipping and French frying, CIP clone 316045.103 (1.29 and 1.36) was comparable. The clones were again planted in September 2019 and harvested in December 2019.
2. Fourteen clones at F_1C_4 stage were planted in September and harvested in December 2019. (These are the same clones which were evaluated in Dalat during February 2019.) The planting was

delayed for more than 1 month intentionally to avoid rainy season, which is adverse for potato crop. Despite delaying of planting, the crop was badly affected by the extended rainy season and, at 50–60 days after planting, the trial was severely infested by LB. Twelve clones were evaluated in the field and 2 clones (HCIP316132.106 and HCIP316078.106) were multiplied in screenhouse. Evaluation of the processing traits will be carried out in the last week of December as per the national protocol. No check varieties could tolerate LB incidence, and the effects were very visible in the yield and quality of their harvested tubers. TAP-5 clones (ie, HCIP316079.206, HCIP316069.204, HCIP316121.108, HCIP316079.203, HCIP316027.101, HCIP316056.220, and HCIP316140.210) showed moderate to high resistance against LB. Among checks, yield of 'Atlantic' was reduced significantly (5.19 t/ha) due to its higher susceptibility to LB; whereas O7 showed some degree of tolerance and produced 14.3 t/ha of tuber yield (Annex 23). Among TAP-5 clones, 5 produced significantly higher yield than the best check O7 for yield, and 8 clones produced higher yield than the best check. Among the clones that showed better resistance to LB, clones HCIP316079.206 (35.9 t/ha), HCIP316079.203 (29.0 t/ha), HCIP316027.101 (33.0 t/ha), and HCIP316140.210 (33.4 t/ha) produced significantly higher yield than the best check O7. While comparing field observations and DNA analysis (Annex 24), the results for LB were very similar. Clones like HCIP316045.103, HCIP316056.103, HCIP316136.101, HCIP316140.214, and HCIP316147.109, which were highly susceptible to LB, also showed absence of any marker during DNA analysis. However, the remaining clones showed good LB resistance in the field and same was confirmed from the lab analysis.

3. Fifty-one clones at F_1C_2 stage were evaluated in Dalat from March to June 2019. This set with sufficient tubers from lowland selections in February 2018 was transferred in Dalat and multiplied in screenhouse conditions from July to September 2018. The clones were evaluated in replicated trials from March to June 2019 based on tuber number obtained from screenhouse. A total of 46 clones were planted in the field, whereas 5 TAP-5 clones were multiplied in screenhouse due to smaller number of tubers. With three replications each, 20 clones were planted with 5 tubers/replication and 9 clones in 10 tubers/replication. Eight clones were replicated twice with 5 tubers under each replication. Remaining 9 clones could not be replicated. Eighteen clones were selected from replicated and nonreplicated trials (Annexes 25–36), clones HCIP316170.202 (48.3 t/ha), HCIP316009.203 (40.8 t/ha), HCIP316056.222 (38.9 t/ha), and HCIP316041.203 (37.5 t/ha) produced significantly higher yield than the checks in their respective trials. Clone HCIP316041.205 produced comparable yield with better DM content (34.3 t/ha and 20.3%). These 18 clones were planted again in November 2019 and will be harvested in February 2020.
4. Owing to severe biotic stresses at the trial sites across highlands and lowlands in the form of viruses, BW, LB, nematodes, and others, the quality of the tubers as seed or planting material has degraded. Seed degeneration is very much visible in all the advanced trials being conducting from sets 1 and 2.

Selections in scheme 3 consisting of set 3

This scheme involves evaluation of set 3, which was received 1 year later than sets 1 and 2. Under this shipment 49 families were received (they were the product of the same crossing programme as of sets 1 and 2). From set 3 8 clones in Dalat were selected in December 2019, and 16 clones selected from same sets are under evaluation in RRD at F_1C_3 stage during current season.

Hai Phong

Forty-eight clones with sufficient tubers selected from 71 clones of set 3 in Dalat during June 2018 were evaluated at F_1C_2 stage in replicated trials in Hai Phong from November 2018 to February 2019. Sixteen clones were selected based on tuber yield, disease resistance, and tolerance (Annexes 37–43). Although selected clone HCIP316140.5 was not analysed due to very few plants. In replicated trial, clones HCIP316054.2 (48.4 t/ha) and HCIP316170.1 (42.1 t/ha) produced higher yield than the best yielder check 'Solara' (40.9 t/ha) but were not significantly higher. Clone HCIP316121.1 produced better yield and equal DM (32.1 t/ha and 23.5%) than 'Atlantic' (28.3 t/ha and 23.5%). In a nonreplicated trial, clone HCIP316073.3 yielded 32.5 t/ha with DM of 24.2%. The clone needs more verification and is being evaluated currently in Hai Phong in the replicated trial.

Dalat

1. Seventy-one clones were evaluated in Dalat from November 2018 to February 2019 at F_1C_2 stage. Owing to large number of clones, the trial was planted in two parts—one part consisted of 33 clones and the other accommodated 36 clones. Two clones were multiplied in screenhouse due to a smaller number of tubers. In the field 41 clones were kept at harvesting based on their appearance and yield, but 11 clones were later rejected after checking their virus status during the crop season. In the field 15 clones from the first trial, 8 from a second trial, and 20 clones were selected on individual plot data. Thirty-two clones were retained for further evaluation (Annexes 44–55). Ten clones out of 15 from the first trial produced significantly higher yield (more than 33.7 t/ha) than the best check 'Atlantic'. Clone HCIP316132.7 (59.7 t/ha) was the best yielder, followed by HCIP316014.2 and HCIP316040.7 (54.4 t/ha each). All the selected clones were evaluated for DM and reducing sugar, whereas clones having sufficient tubers were evaluated for chipping quality, French frying, and boiling. Clones HCIP316014.2 (54.4 t/ha and 22.0%) and HCIP316007.1 (46.9 t/ha and 22.5%) produced significantly higher yield combined with fair amount of DM. In a second replicated trial 3 out of 8 clones produced significantly higher yield than the best yielder check PO3 (more than 36.1 t/ha). In the same trial clone HCIP316041.1 produced significantly higher yield of 41.0 t/ha with 22.2% DM. In nonreplicated trial HCIP316078.106 produced good yield (46.4 t/ha), whereas clone HCIP316140.4 produced high yield (38.5 t/ha) in combination with good DM (21.7%). In the same trial 9 clones achieved DM above 21.0%. Across all the trials many clones having high DM could not be tested for chipping and French frying due to limited tubers availability.
2. Thirty-two clones were evaluated at F_1C_3 stage from September to December 2019 in farmers' fields in Dalat. Owing to extended rainy season, LB infested the crop severely and the clones possessing some tolerance or resistance could sustain in the field. Eight clones were selected from the trial and all showed moderate or higher level of resistance to LB. Fourteen clones showed fair amount of resistance out of 29; 8 were selected in the field (Annex 56). 'Atlantic' (5.51 t/ha) and PO3 (8.77 t/ha) could not tolerate LB and the yields were very low. All the selected clones produced significantly higher yields than 'Atlantic' and PO3. Although O7 also was a very poor performer, its yield was little better than both the checks due to better tolerance for LB. Except for HCIP316041.1 and HCIP316063.4, all the selected clones produced significantly higher yield than O7 (14.4 t/ha). Yield of these two clones was also higher than O7 but was not statistically superior. A thorough analysis of processing traits, including chipping, DM, and French-frying ability, will be done later to follow the national protocol for such traits, which needs a gap of approximately 10 days from the day of harvesting.

Selections in scheme 4 consisting of set 4

- TS of set 4 were sown in September 2018 in a screenhouse at Dalat. Approximately 7,500 seedlings were transplanted in November 2018 and harvested in February 2019. Evaluation was done in pots in screenhouse under disease-free conditions. As the clones were planted in pots and were at early stage, those with defects, undesirable tuber and flesh colour, poor shape, and deep eyes were rejected. Yield was not the criterion for selection at this stage. A total of 3,590 clones were selected at this stage. Maximum 84 selections were made in families HCIP317178 (CIP388676.1 x HOM 13-8236) and HCIP317154 (CIP309050.36 x HO 11-8336), followed by 80 selections in HCIP317165 (CIP309129.11 x VR 808) and 69 selections in HCIP317127 (CIP390478.9 x HO 11-8336) (Annex 8).
- The selected 3,590 clones were planted again in August 2019 at a PVFC field with one row each of all the clones planting a maximum of five tubers for each. One copy of each clone was multiplied and maintained under screenhouse clean condition. Though the planting was postponed intentionally to avoid rainy season, the extended spell severely affected the crop regardless. The field selections were supplemented by evaluating material in the screenhouse. The selections were made based on the appearance, water-logging capacity, tuber shape, eye depth, and healthy tubers. A total of 368 selections were made from the population in which 139 selections were from screenhouse, 227 from field, and 3 were common for both (Annex 8). A maximum of 18 selections were made from family HCIP317048 (CIP304369.22 x HOM 13-8236), followed by 15 in HCIP317230 (CIP397006.18 x HOM 13-8236), 14 in HCIP317228 (CIP309076.59 x HOM 13-8236), and 13 in HCIP317180.14 (CIP398208.620 x HOM 13-8236). Interestingly, HOM 13-8236 is the common male parents among all these families, which is a good source of resistance to potato cyst nematode, PVY, and LB, and is a high yielder with good DM and processing quality.

Evaluation of advanced CIP material to test their candidature

We decided to test advanced CIP material generated from more than 10 years of breeding efforts by crossing CIP germplasm in local conditions. The clones have been developed from different populations including lowland tropics virus resistance and LB–heat tolerance. The clones were tested in different replicated trials under the TAP-5 project, a majority of which included 27m^2 trials accommodating 135 tubers split in three replications.

Hai Phong

The trial was conducted in lowland from November 2018 to February 2019 by involving six advanced clones along with local checks. The trials were planted in 9m^2 per replication with three replications accommodating 135 plants for each clone. VR08-1-3-147 produced maximum yield of 41.5 t/ha and was significantly higher than two checks 'Atlantic' (34.4 t/ha) and 'Solara' (29.2 t/ha). DM of the clone was also appreciable (20.9%). None of the clones could surpass 'Marabel' for yield significantly, though VR01-1-47 and VR08-1-3-147 produced higher yields (Annexes 57–60).

Dalat

Four CIP advanced clones were evaluated from November 2018 to February 2019, along with local checks. The trials were planted in 9m^2 per replication with three replications accommodating 135 plants for each clone. Owing to a smaller number of tubers, VR08-1-3-147 (10) and VR01-1-2 (37) were planted with fewer tubers per replication. Clone VR08-1-3-147 produced significantly higher yield (46.5 t/ha) than all the check varieties and with appreciable DM of 21.2% (Annexes 61–63). Chipping quality of VR01-1-2 (1.64) was closer to that of 'Atlantic' (1.21).

The scale used in the study is described in Annex 66.

2.3 Current Activities

Dalat

- Eighteen clones selected from set 2 are being evaluated at F_1C_3 stage in replicated trials. These same clones are being multiplied in screenhouse.
- *In vitro* multiplication of virus-free plantlets tested through ELISA are to be sent to FERA, UK for validation of other diseases. Disease-free mother plants will be used for germplasm export, local seed multiplication, and DUS and VCU.
- *In vitro* multiplication of remaining advanced selected clones in laboratory at PVFC is running simultaneously.
- A set of DNA extraction of the most advanced clones has been sent to HZPC for testing of disease resistance and true to type.

Hai Phong

During the current season four trials are at farmers' fields in Hai Phong, RRD. The trials are being evaluated along with local checks 'Solara', 'Marabel', and 'Atlantic'.

- Seventeen clones selected from 51 in last season in Hai Duong received under set 2 have been planted in three replications in November and are under evaluation at F_1C_3 stage.
- Sixteen clones selected from 48 from set 3 are being evaluated under replicated trials.
- Six most advanced clones from merged sets 1 and 2 are under replicated evaluation in two locations.
- The material selected from CIP germplasm previously under another programme is being evaluated in replicated trials at two locations in farmers' fields to test their suitability for TAP-5 product profile.
- Two trials deviating from the normal planting time have been planted in Chuong My to test the performance of advanced clones under high temperature.

2.4 Supporting Approaches Adopted in the Project

Following the recommendations of the stakeholders' decision during annual review meeting in Dalat in February 2019:

- A cross-reference table of most advanced promising 11 clones were prepared and shared according to their suitable sector—processing and fresh in lowland and highlands.
- A regular discussion is on among stakeholders of SFSA, HZPC, and CIP to develop a road map for product launch in India, Indonesia, and Tanzania/Kenya.
- Efforts have been going on to establish a network and collect information on germplasm export to the targeted countries, where advanced clones will be shipped.
- TAP-5 team actively helped prepare a draft of variety release policy in Vietnam and provided their suggestions for a simplified process. The team is continuously coordinating with the key members of the committee to remain updated with the latest developments.
- Information is being gathered, compiled, and shared among the team working on marketing plans.
- A time schedule has been prepared for VCU and DUS testing and protection of varieties.

- To verify the disease- and virus-free status of the *in vitro* plants of selected eleven clones, FERA in the UK has been contacted and information collected. Virus-free plantlets (tested from ELISA) will be sent to FERA to test the presence or absence of certain diseases and viruses.

2.4.1 Genotyping of advanced population

To determine the disease-resistance ability at early stage, DNA isolates samples of the selected advanced clones from F_1C_2 generation were sent to HZPC, Holland, in May 2019. The clones were tested for their resistance ability against LB, cyst nematode, PVY, and tobacco rattle virus. Fifty-six clones, including from set 2 and advanced CIP clones, were tested (Annex 64). Another set of selected 11 clones have been sent to HZPC in December 2019. The samples from field trials and virus-free *in vitro* plants have been collected and transferred.

- ELISA kits were imported from CIP–Lima to test the virus presence of *in vitro* plantlets of the advanced selected 11 clones. Standards were bought locally from Vietnam. Ten clones were found to have *in vitro* plants free of viruses, but 1 clone, VR08-1-3-147, could not be found negative for the viruses (Annex 65).
- *In vitro* multiplication of selected advanced clones is being done in PVFC laboratory. On the basis of the results obtained from ELISA testing, four *in vitro* tubes each of virus negative clones are being multiplied to send to FERA for further evaluation of different viruses and bacteria. Also, simultaneously, *in vitro* of same healthy plantlets are being multiplied for germplasm export and local seed multiplication.
- Gaining insight with the potato variety registration process. During 2019 Vietnamese authority is drafting its new variety release policy. It should be finalised at the end of the year and likely to be effective in January 2020. TAP-5 Vietnam team closely followed all the developments round the year and prepared itself accordingly.

Compilation of information

- According to latest updates in the workshop, potato is not among the major crops. We may need to submit a self-announcement for variety proposal. The self-announcement should be prepared based on the internal trials conducted by the proposers. The self-announcement needs three main documents: information on the clone, including pedigree and their traits, performance of the clones based on the national protocol, and cultivation and seed production protocols. At present, we are recording data following the national protocol combined with CIP's protocol, to collect maximum information. The national cultivation protocol is under draft; if it is available before or at the time of self-announcement, the same will be adapted.
- The germplasm export policy is being drafted, which is an important requirement of TAP-5 project. The new policy on germplasm export should be declared early next year. The current export policy does not mention germplasm, it only covers varieties. Also, it is mandatory to share the benefits for Vietnam while exporting material.
- The protocols on VCU and DUS have been collected and the material required for these are being multiplied in lab through disease-free *in vitro* plantlets. A timeline for DUS and VCU testing has been prepared.

2.5 Meetings and Workshops to Follow-up New Policies Drafts

- Dr Tran Xuan Dinh, deputy director general of the Department of Crop Production (DCP), was invited to the TAP-5 annual review meeting held in Dalat in February 2019. He delivered a

presentation on the variety release processes and discussed the possible changes in the new policies including variety release and germplasm export. (Dr Dinh retired from the DCP in October 2019 and now is working as the secretary of the Vietnamese Seed Association. He is contacted by the TAP-5 team regularly and when some information is needed.)

- At a March 10th meeting at the CIP office Dr Dinh provided comprehensive information on germplasm export, issuance of permit for germplasm export, phytosanitary certification capacities of local authorities, and expectation from the new variety registration policies. Minutes of the meeting were circulated among all the TAP-5 team.
- Policymakers had invited suggestions from different national and international organisations for preparing draft proposals to be presented to the higher authorities. The TAP-5 team participated in the meeting on August 27th 2019, organised by the DCP and the Vietnamese Seed Association and provided important inputs. Main emphasis was on replacing the mandatory 50ha trials for variety registration for potato. We expect that these trials will not be part of the new potato registration processes. TAP-5 also provided financial support to the meeting which was agreed during an annual review meeting in February.
- The TAP-5 Vietnam team participated in the workshop "Potato production to consumption workshop", organised by Fresh Studio on May 22nd and 23rd in Hanoi. At the workshop there were presentations and discussions on potato variety registration policies and procedures, market requirements, and potato seed markets for South-eastern Asian countries.

2.5.1 Compiling information and documents required for exporting advanced germplasm

To test the performance of selected advanced clones and propose them as varieties, TAP-5 is targeting India, Indonesia, and Kenya (or Tanzania). The information on the requirements and protocols that need to be followed for variety registration for these countries is being collected and complied. After consultation with the national authorities in Vietnam, it was found that the local system is not well-equipped with some of required phytosanitary testing mandatory for export. So, it has become imperative that we should have more information from the importing countries about their requirements on documentation and phytosanitary certificates. To support our claim for disease-free material export, we have tested *in vitro* of the selected clones through ELISA kits for six viruses (ie, PVX, PVY, PVA, PVS, PVM, and PLRV). The virus-negative clones will be sent to FERA, UK for further testing for presence of some other viruses, bacteria, and others of these plantlets multiplied from virus-negative mother plants. HZPC also will use the official Dutch quarantine route to adopt clean stock material at the vitro lab of HZPC Research.

2.5.2 TAP-5 product launch plan

The team now includes marketing experts from HZPC and SFSA and will be drafting a launch plan for selected advanced clones for the targeted countries. Potato market information and market size of processing and fresh sectors of India, Indonesia, and Kenya (or Tanzania) is being collected from different possible sources, including those available online. A product launch timeline has been developed which will be presented and discussed in the February 2020 annual review meeting. For Vietnam also, a launch road map has been prepared for DUS, VCU, and product launch.

2.5.3 Review and update meetings

- **February 2019, Dalat, Vietnam.** On February 15th 2019, an annual review meeting of the TAP-5 project was held in Dalat. In addition to TAP-5 stakeholders from SFSA, HZPC, and CIP, first half of the meeting was attended by Mr Nhuan, director of the PVFC, and Dr Dinh of the DCP.

Much discussion took place among the stakeholders in the second half. Some of the outcomes are that we decided to (1) prepare a cross-reference table of the most promising clones based on their suitable agro-ecologies and consuming sectors; (2) form a development team to prepare stage 5 trials in Vietnam and exports to other countries; (3) collect information on import and document requirements for exporting countries; (4) contact the DCP for export purpose according to the import requirements of the targeted countries; (5) follow up closely on variety registration draft policy of Vietnam; and (6) develop a pathway for the coming years for advanced clones.

- **June 19th 2019, Dalat.** The meeting was followed by harvesting of the TAP-5 material in Dalat. Dr Cuong and Herve (through Skype); Dr Chien, Neeraj, and Nhung from CIP; and Wichard and Rian from HZPC participated. Focus of the discussion revolved around export of the selected clones, variety registration and protection of varieties in these countries, testing and cleaning of *in vitro* stock, budget preparation for the coming period, pathways development, new variety release policy in Vietnam, and planting of next-season trials. We also decided to have regular Skype calls among the team to follow up on the allocated responsibilities. Accordingly, the meeting was followed by regular skype calls on September 10th and 19th, October 3rd, and November 18th 2019.
- **December 11th 2019, Dalat.** The review-cum-strategy meeting took place after advanced clones were harvested in Dalat. Attending were Herve and Dr Cuong from SFSA; Wichard and Rian from HZPC; and Neeraj, Dr Chien, Trang, and Nhung from CIP. The product profile was updated based on the testing done so far. Herve was assigned to prepare a high-level business case, whereas Rian was asked to provide potato market information. A budget plan was drafted for the coming years, including beyond allocated TAP-5 time.

2.6 IMPROVEMENTS

The online and personal meetings resulted in regular updates and improvement in the related issues (eg, germplasm export and cleaning, variety registration, budget planning, etc.). The collected information kept on changing due to the drafting of the important policies.

Some suggestions were followed:

- Selection of top-performing clones to be proposed for varieties in Vietnam and for germplasm export.
- Product profile was further improved by including the tested performances under the project.
- The *in vitro* plants of the selected clones were tested against PVX, PVY, PVA, PVS, PVM, and PLRV by importing ELISA kits from CIP–Lima. Purpose of the testing is to reduce the chances of infected material for export purpose.
- FERA in UK was approached to enquire about the testing of other relevant biotic stresses in *in vitro* plant. Cost of the tests and time period were also discussed.
- Sprinkler/foggers inside create a more conducive environment for disease incidence due to higher temperature coupled with increased air humidity. The screenhouse was fitted with drip irrigation, which helps in better management of fertilisation and irrigation, and does not increase air humidity.
- Fans were also fitted in the screenhouse to control the temperature during noon hours.
- A new pre-breeding population of 49 families was developed in Peru by crossing parents of a CIP BW-resistant population with HZPC clones.

2.7 Institutional Commitments/Agreements

The running agreements between CIP and the local national partners (PVFC) and Field Crops Research Institute) have been renewed.

- The PVFC is supporting implementation of trials in farmers' fields and at the screenhouse in Dalat. The institute is also maintaining the *in vitro* stock of selected advanced clones of the project and provides its facilities for ELISA testing of the selected clones.
- Field Crops Research Institute is implementing trials in farmers' fields and at its campus in Hai Phong, RRD. Selected clones have been cold stored in the institute's facility.

2.9 Main Learning Points

- Facilities of testing phytosanitary requirement for germplasm export are not sufficient in Vietnam. They therefore need to test germplasm with all possible sources, and then approach the authorities of importing countries.
- Information on marketing scenario is not adequate for the targeted countries. More sources are needed to have a reliable dataset on which to build a strong case for the successful product launch.

3. FUTURE PLANS

- The selected and virus-free clones will be sent to FERA, UK for testing of some other viruses, bacteria, and diseases.
- The process for variety registration, DUS, testing and VCU testing will be initiated for Vietnam.
- Protection of varieties in Vietnam will be initiated once the DUS results are available.
- Germplasm export will be done after getting the health status check done of selected clones of *in vitro* plants. Information is being collected on the documents required and testing to be done for the targeted countries.
- The drafted timeline will be finalised for Vietnam and other targeted countries for the product launch.
- The regular testing of the clones under field and lab conditions will be continued for the further validation of selected clones and to identify new clones from the later generations.
- The next annual review meeting will happen in mid-February 2020 in Hanoi.

4. SITES FOR PLANTING POTATO EXPERIMENTS

Potato experiments are being conducted in the following regions and sites.

- **RRD**

  5–10 masl: Hai Duong and Hai Phong. The sites are around 120km from Hanoi. Hai Phong is popular for commercial cultivation of 'Atlantic' and provides favourable conditions for potato production during winter season.

- **Central highland/tropical highland**

  Dalat (1,500 masl) in Lam Dong province of the central highlands (1,495km from Hanoi) is a tropical highland potato-growing region. Thanks to favourable conditions throughout the year, potato can be produced all year-round. Duc Trong (900 masl) in Dalat, Lam Dong province of the central highland, is 10km from Dalat airport. Potatoes can be cultivated once a year.

ANNEXES

ANNEX 1. CIP PROGENITORS CONTRIBUTING TO TAP-5 HYBRID POPULATION AS FEMALE PARENTS IN DEVELOPING BW-RESISTANT POPULATION

Ord	Accession Number	Genetic Background	Female Parent	Male Parent	Tuber morphology				BW resist	Pollen viability	
					Skin colour	Flesh colour	Tuber shape	Eye depth		%	Description
1	**CIP509506.2**	*Commersoni, tuberosum, andigena*	8302.2	Bulk CIP BW	Splashed	White	Oval	Medium	R	63.0	Moderate
2	**CIP509506.3**	*Commersoni, tuberosum, andigena*	8302.2	Bulk CIP BW	Pink	White	Oval	Medium	R	30.6	Low
3	**CIP509509.1**	*Commersoni, tuberosum, andigena*	08302.4 (BC1 cmm)	8809.2						81.9	High
4	**CIP509509.6**	*Commersoni, tuberosum, andigena*	08302.4(BC1 cmm)	8809.2	Brown	White	Oval	Medium	R	63.6	Moderate
5	**CIP509510.1**	*Commersoni, tuberosum, andigena*	08302.4 (BC1 cmm)	Bulk CIP BW						69.5	Moderate
6	**CIP509501.2**	*Commersoni, tuberosum, andigena*	8301.1	Bulk CIP BW	Cream	White	Oval	Shallow	MR	--	--
7	**CIP509510.3**	*Commersoni, tuberosum, andigena*	08302.4 (BC1 cmm)	Bulk CIP BW	Purple	White	Oval	Medium	R	43.9	Low

R: Resistant, MR: Moderately Resistant,

ANNEX 2. HZPC PROGENITORS CONTRIBUTING TO TAP-5 HYBRID POPULATION AS MALE PARENTS

Tube code	Progenitor	type G=Granola, A=Atlantic	RELATIVE YIELD	MATURITY 40-90	DORMANCY PERIOD 10-90	TUBER SIZE 90 = 70 mm+	SHAPE	FLESH COLOUR	SKIN COLOUR	OVERALL IMPRESSION	DM%	COOKING TYPE	SECOND FRY 10-90	CRISPS 10-90	LATE BLIGHT FOLIAGE 10-90
HCIP 7024	MERIDA	G	92	69	58	80	ROO	Y	Y	68	18.5	firm-bit mealy	57		43
HCIP 7049	HOM 15-7266	G	121	58	58	81	RO	Y	Y	59	22.4	bit mealy	69	55	99
HCIP 7051	HOM 16-7097	G	111	70	60	75	O	Y	DY	70	19.8	bit mealy	80	75	
HCIP 7054	HOM 15-7282	G	94	65	32	63	LO	Y	Y	67	19.5	bit mealy	73	64	99
HCIP 7056	HOM 16-7092	G	117	65	60	75	OLO	Y	Y	69	20.5	bit mealy	73	70	
HCIP 7064	HOM 13-8226	G	129	54	73	85	OLO	Y	Y	66	20.3	firm-bit mealy	59	48	99
HCIP 7065	HOM 13-8236	A	124	66	55	83	O	LY	Y	66	22	bit mealy	72	65	97
HCIP 7067	HOT 15-7202	G	114	55	60	73	OLO	LY	Y	69	18.8	firm	76	45	
HCIP 7072	HOM 16-7099	G	109	60	87	65	RO	Y	Y	65	19.5	firm-bit mealy	80	75	
HCIP 7074	HOM 16-7210	G	107	65	87	68	LO	LY	Y	69	20	bit mealy	62		
HCIP 7075	HOM 16-7095	G	111	65	87	73	OLO	LY	LY	68	19.1	bit mealy	76		
HCIP 7077	HOM 15-7707	G	93	60	78	66	O	Y	Y	61	21.5	bit mealy	65	60	99
HCIP 7093	HOM 13-7870	G	91	71	49	82	LO	Y	Y	70	16.6	firm-bit mealy	49	35	85
HCIP 7098	HZD 08-1059	G	108	68	95	84	O	Y	DY	68	18.3	bit mealy	51		
HCIP 8033	HO 11-8336	G	86	57	23	63	OLO	DO	Y	62	20.4	bit mealy	58	45	38
HCIP 8048	HO 11-8299	G	77	64	53	58	LO	LY	DY	64	21	bit mealy	63	55	29
HCIP 8053	HOM 14-7845	G	70	68	83	50	LO	Y	Y	60	18.8	bit mealy	64	53	99

LO=long oval, OLO=oval-long-oval, O=oval, ROO=Round-oval-oval, DY= dark yellow, Y= yellow, LY= light yellow

ANNEX 3. STATUS OF CROSSING PROGRAMME FOR BW POPULATION

	Female parents			Male parents			Fruits	Seeds
	Accession #	**Code**	**Traits**	**Accession #**	**Code**	**Traits**		
1	CIP509506.2	9506.2	BW_R	HCIP 7024	MERIDA	PVY, Precocity	**45**	**1357**
2	CIP509506.2	9506.2	BW_R	HCIP 7049	HOM 15-7266	PVY, Precocity	**70**	**2623**
3	CIP509506.2	9506.2	BW_R	HCIP 7054	HOM 15-7282	PVY, Precocity	**7**	**13**
4	CIP509506.2	9506.2	BW_R	HCIP 7056	HOM 16-7092	PVY, Precocity	**5**	**0**
5	CIP509506.2	9506.2	BW_R	HCIP 7075	HOM 16-7095	PVY, Precocity	**4**	**0**
6	CIP509506.2	9506.2	BW_R	HCIP 7098	HZD 08-1059	PVY, Precocity	**78**	**503**
7	CIP509506.2	9506.2	BW_R	HCIP 8048	HO 11-8299	PVY, Precocity	**41**	**17**
8	CIP509506.2	9506.2	BW_R	HCIP 8053	HOM 14-7845	PVY, Precocity	**10**	**1**
9	CIP509506.2	9506.2	BW_R	HCIP 7064	HOM 13-8226	PVY, Precocity	**25**	**191**
10	CIP509506.2	9506.2	BW_R	HCIP 8033	HO 11-8336	PVY, Precocity	**4**	**0**
11	CIP509506.3	9506.3	BW_R	HCIP 7024	MERIDA	PVY, Precocity	**19**	**1835**
12	CIP509506.3	9506.3	BW_R	HCIP 7049	HOM 15-7266	PVY, Precocity	**24**	**1974**
13	CIP509506.3	9506.3	BW_R	HCIP 7054	HOM 15-7282	PVY, Precocity	**4**	**38**
14	CIP509506.3	9506.3	BW_R	HCIP 7067	HOT 15-7202	PVY, Precocity	**5**	**12**
15	CIP509506.3	9506.3	BW_R	HCIP 7098	HZD 08-1059	PVY, Precocity	**15**	**450**
16	CIP509506.3	9506.3	BW_R	HCIP 8048	HO 11-8299	PVY, Precocity	**5**	**3**
17	CIP509506.3	9506.3	BW_R	HCIP 7064	HOM 13-8226	PVY, Precocity	**14**	**420**
18	CIP509506.3	9506.3	BW_R	HCIP 8033	HO 11-8336	PVY, Precocity	**7**	**39**
19	CIP509509.1	9509.1	BW_MR	HCIP 7024	MERIDA	PVY, Precocity	**5**	**560**
20	CIP509509.1	9509.1	BW_MR	HCIP 7049	HOM 15-7266	PVY, Precocity	**9**	**1690**
21	CIP509509.1	9509.1	BW_MR	HCIP 7065	HOM 13-8236	PVY, Precocity	**2**	**1**
22	CIP509509.1	9509.1	BW_MR	HCIP 7098	HZD 08-1059	PVY, Precocity	**1**	**50**
23	CIP509509.1	9509.1	BW_MR	HCIP 8048	HO 11-8299	PVY, Precocity	**2**	**0**
24	CIP509509.1	9509.1	BW_MR	HCIP 7064	HOM 13-8226	PVY, Precocity	**3**	**2**
25	CIP509509.6	9509.6	BW_R	HCIP 7024	MERIDA	PVY, Precocity	**35**	**2352**
26	CIP509509.6	9509.6	BW_R	HCIP 7049	HOM 15-7266	PVY, Precocity	**48**	**3616**
27	CIP509509.6	9509.6	BW_R	HCIP 7098	HZD 08-1059	PVY, Precocity	**56**	**1134**
28	CIP509509.6	9509.6	BW_R	HCIP 8048	HO 11-8299	PVY, Precocity	**39**	**15**
29	CIP509509.6	9509.6	BW_R	HCIP 7064	HOM 13-8226	PVY, Precocity	**38**	**917**
30	CIP509509.6	9509.6	BW_R	HCIP 8033	HO 11-8336	PVY, Precocity	**6**	**37**
31	CIP509510.1	9510.1	BW_MR	HCIP 7024	MERIDA	PVY, Precocity	**12**	**1565**
32	CIP509510.1	9510.1	BW_MR	HCIP 7049	HOM 15-7266	PVY, Precocity	**19**	**1700**
33	CIP509510.1	9510.1	BW_MR	HCIP 7098	HZD 08-1059	PVY, Precocity	**6**	**340**
34	CIP509510.1	9510.1	BW_MR	HCIP 8048	HO 11-8299	PVY, Precocity	**14**	**11**
35	CIP509510.1	9510.1	BW_MR	HCIP 8053	HOM 14-7845	PVY, Precocity	**2**	**0**
36	CIP509510.1	9510.1	BW_MR	HCIP 7064	HOM 13-8226	PVY, Precocity	**13**	**627**
37	CIP509510.1	9510.1	BW_MR	HCIP 8033	HO 11-8336	PVY, Precocity	**4**	**200**
38	CIP509501.2	9501.2	BW_MR	HCIP 7075	HOM 16-7095	PVY, Precocity	**1**	**0**
39	CIP509501.2	9501.2	BW_MR	HCIP 7098	HZD 08-1059	PVY, Precocity	**1**	**16**
40	CIP509510.3	9510.3	BW_R	HCIP 7024	MERIDA	PVY, Precocity	**42**	**4057**
41	CIP509510.3	9510.3	BW_R	HCIP 7049	HOM 15-7266	PVY, Precocity	**78**	**5869**
42	CIP509510.3	9510.3	BW_R	HCIP 7054	HOM 15-7282	PVY, Precocity	**3**	**74**
43	CIP509510.3	9510.3	BW_R	HCIP 7065	HOM 13-8236	PVY, Precocity	**1**	**5**
44	CIP509510.3	9510.3	BW_R	HCIP 7072	HOM 16-7099	PVY, Precocity	**8**	**38**
45	CIP509510.3	9510.3	BW_R	HCIP 7093	HOM 13-7870	PVY, Precocity	**1**	**5**
46	CIP509510.3	9510.3	BW_R	HCIP 7098	HZD 08-1059	PVY, Precocity	**56**	**1385**
47	CIP509510.3	9510.3	BW_R	HCIP 8048	HO 11-8299	PVY, Precocity	**77**	**29**
48	CIP509510.3	9510.3	BW_R	HCIP 7064	HOM 13-8226	PVY, Precocity	**38**	**1479**
49	CIP509510.3	9510.3	BW_R	HCIP 8033	HO 11-8336	PVY, Precocity	**2**	**14**
	Total						**1004**	**37264**

BW_R= Bacterial wilt resistance; BW_MR= Bacterial wilt moderately resistant

ANNEX 4. SELECTIONS' PROGRESS UNDER SCHEME 1

Sr No	TS family	Dalat Feb 2017,	Dalat Oct, 17	Dalat June 18,	Dalat Feb 19	Hai Phong Feb 19	Dalat Dec 19
1	HCIP316002						
2	HCIP316007	6					
3	HCIP316008	2					
4	HCIP316009	2					
5	HCIP316013	3					
6	HCIP316014						
7	HCIP316018	1					
8	HCIP316019						
9	HCIP316020	6					
10	HCIP316039						
11	HCIP316040	2					
12	HCIP316041	4					
13	HCIP316049	5					
14	HCIP316050						
15	HCIP316053	4					
16	HCIP316054	1					
17	HCIP316055	1					
18	HCIP316056	5	1	1	1	1	1
19	HCIP316057	13					
20	HCIP316062	1					
21	HCIP316063	6					
22	HCIP316064	3					
23	HCIP316069	3					
24	HCIP316073						
25	HCIP316074	3					
26	HCIP316075	1					
27	HCIP316079						
28	HCIP316080						
29	HCIP316083	2					
30	HCIP316084	4					
31	HCIP316085	4					
32	HCIP316094	2					
33	HCIP316095	2					
34	HCIP316100	3					
35	HCIP316101						
36	HCIP316102	2					
37	HCIP316103	3					
38	HCIP316121	21	1	1	1		1
39	HCIP316125	4					
40	HCIP316126	4					
41	HCIP316127	1					
42	HCIP316132	6	1	1	1	1	1
43	HCIP316136	4	2	1	1	1	1
44	HCIP316140	1					
45	HCIP316147	9	1	1	1		1
46	HCIP316148	7					

Sr No	TS family	Dalat Feb 2017,	Dalat Oct, 17	Dalat June 18,	Dalat Feb 19	Hai Phong Feb 19	Dalat Dec 19
47	HCIP316153	7					
48	HCIP316163	9	2	1			
49	HCIP316169						
50	HCIP316170	14	1				
51	HCIP316172	1					
52	HCIP316173	8	1				
53	HCIP316174	8					
54	HCIP316175	7					
55	HCIP316177						
Total		**205**	**10**	**6**	**5**	**3**	5

ANNEX 5. SELECTIONS' PROGRESS UNDER SCHEME 2 (64 FAMILIES)

Sr No	TS Family	Dalat Oct 17	Hai Duong Feb 18	Dalat June 18	Dalat Feb 19	Hai Phong Feb 19	Dalat, June 19	Dalat Dec 19
1	HCIP316003							
2	HCIP316006							
3	HCIP316015							
4	HCIP316017							
5	HCIP316021							
6	HCIP316023							
7	HCIP316026							
8	HCIP316027	1	2	1	1			1
9	HCIP316028							
10	HCIP316033							
11	HCIP316034		1			1	1	
12	HCIP316035							
13	HCIP316038		1					
14	HCIP316044							
15	HCIP316045	1		1	1			1
16	HCIP316052							
17	HCIP316060							
18	HCIP316066							
19	HCIP316067							
20	HCIP316068							
21	HCIP316070							
22	HCIP316078	2		1	1			1
23	HCIP316087							
24	HCIP316088							
25	HCIP316091							
26	HCIP316092							
27	HCIP316093							
28	HCIP316097							
29	HCIP316098							
30	HCIP316099		2				1	
31	HCIP316106							
32	HCIP316107							
33	HCIP316110							
34	HCIP316111		1					
35	HCIP316115							
36	HCIP316116		2			2	2	
37	HCIP316117							
38	HCIP316118							
39	HCIP316120							
40	HCIP316122							
41	HCIP316123							
42	HCIP316124							
43	HCIP316130							
44	HCIP316131							
45	HCIP316133							
46	HCIP316135							
47	HCIP316138							
48	HCIP316141							

Sr No	TS Family	Dalat Oct 17	Hai Duong Feb 18	Dalat June 18	Dalat Feb 19	Hai Phong Feb 19	Dalat, June 19	Dalat Dec 19
49	HCIP316142							
50	HCIP316144		2			1	1	
51	HCIP316145							
52	HCIP316146							
53	HCIP316151							
54	HCIP316154							
55	HCIP316155							
56	HCIP316156							
57	HCIP316157							
58	HCIP316158							
59	HCIP316159							
60	HCIP316164							
61	HCIP316165							
62	HCIP316166							
63	HCIP316171							
64	HCIP316178							
	Total	**4**	**11**	**3**	**3**	**4**	**5**	**3**

ANNEX 6. SELECTIONS' PROGRESS UNDER SCHEME 2 (55 FAMILIES)

	TS family	Hai Duong March 17	Dalat Oct 17	Hai Duong Feb 18	Dalat June 18	Dalat Feb 19	Hai Phong Feb 19	Hai Phong Feb 19	Dalat June 19	Dalat Dec 19
1	HCIP316002	8								
2	HCIP316007									
3	HCIP316008	2								
4	HCIP316009	7		3			1		1	
5	HCIP316013									
6	HCIP316014									
7	HCIP316018									
8	HCIP316019									
9	HCIP316020	4								
10	HCIP316039									
11	HCIP316040	4		1			1		1	
12	HCIP316041	10		4			2		2	
13	HCIP316049	4		1						
14	HCIP316050	3								
15	HCIP316053	15								
16	HCIP316054	12								
17	HCIP316055	12		2						
18	HCIP316056	28	1	7		1	2		4	1
19	HCIP316057	4								
20	HCIP316062									
21	HCIP316063	8	1	1						
22	HCIP316064	7		1						
23	HCIP316069	10	2		1	1		1		1
24	HCIP316073	8								
25	HCIP316074									
26	HCIP316075									
27	HCIP316079	6	2		1	2				2
28	HCIP316080	5								
29	HCIP316083									
30	HCIP316084	13								
31	HCIP316085	25								
32	HCIP316094	3								
33	HCIP316095	18		1						
34	HCIP316100	2								
35	HCIP316101									
36	HCIP316102	17		2			1		1	
37	HCIP316103	1								
38	HCIP316121	5							1	
39	HCIP316125	5		1						
40	HCIP316126	3		1						
41	HCIP316127									
42	HCIP316132	7		1			1		1	
43	HCIP316136	3								
44	HCIP316140	20	3	4	2	2	2	2	1	2
45	HCIP316147	3								
46	HCIP316148	21		1						
47	HCIP316153									
48	HCIP316163	9								
49	HCIP316169	6		2						

	TS family	Hai Duong March 17	Dalat Oct 17	Hai Duong Feb 18	Dalat June 18	Dalat Feb 19	Hai Phong Feb 19	Hai Phong Feb 19	Dalat June 19	Dalat Dec 19
50	HCIP316170	7		1			1		1	
51	HCIP316172	8		3			1			
52	HCIP316173									
53	HCIP316174	3		2			1			
54	HCIP316175	7		1						
55	HCIP316177									
Total		**343**	**9**	**40**	**4**	**6**	**13**	**3**	**13**	**6**

ANNEX 7. SELECTIONS' PROGRESS UNDER SCHEME 3 (49 FAMILIES)

	TS family	Dalat Oct 17 →	Dalat June, 18	Dalat Feb, 19 →	Hai Phong Feb 19	Dalat Dec, 19
1	HCIP316002	5				
2	HCIP316007	3	1	1		
3	HCIP316008	2				
4	HCIP316009	7	2	2		1
5	HCIP316014	4	2	2		
6	HCIP316020	4	1			
7	HCIP316039	6	2	1		
8	HCIP316040	8	5	3	4	1
9	HCIP316041	4	2	1		1
10	HCIP316049	3	1	1		1
11	HCIP316050	4	1			
12	HCIP316053	1				
13	HCIP316054	6	1	1	1	
14	HCIP316055	5	2			
15	HCIP316056	4				
16	HCIP316057					
17	HCIP316062	6				
18	HCIP316063	5	4	3		2
19	HCIP316064	4	2			
20	HCIP316069	6	1			
21	HCIP316073	6	1		1	
22	HCIP316074	4	1			
23	HCIP316075					
24	HCIP316079	5	2	1		
25	HCIP316080	1				
26	HCIP316083	1				
27	HCIP316084	2				
28	HCIP316094	2				
29	HCIP316095	1				
30	HCIP316100	2				
31	HCIP316101	6				
32	HCIP316102	12				
33	HCIP316103	2	1			
34	HCIP316121	4	2	1	2	
35	HCIP316126	3				
36	HCIP316132	11	5	1	2	1
37	HCIP316136	3	1	1		
38	HCIP316140	11	4	3	2	1
39	HCIP316147	4	4	3	1	
40	HCIP316148	2	1			
41	HCIP316153	1				
42	HCIP316163	4	1	1		
43	HCIP316169	8	2	1		
44	HCIP316170	6	5		1	
45	HCIP316172	6	1	1		
46	HCIP316173	3	2	1		
47	HCIP316174	11	2	2	1	
48	HCIP316175	3	2		1	
49	HCIP316177	13	6	1		
	Total	**224**	**70**	**32**	**16**	8

ANNEX 8. SELECTIONS' PROGRESS UNDER SCHEME 4 (83 FAMILIES)

Sr no	Clone	Female	Male	Dalat Feb 19	Dalat Dec 19
1	HCIP317040	CIP304369.22	VR 808	63	6
2	HCIP317041	CIP304369.22	HO 11-8336	46	8
3	HCIP317044	CIP392820.1	HOM 13-8226	16	3
4	HCIP317048	CIP304369.22	HOM 13-8236	65	18
5	HCIP317050	CIP397006.18	HZA 11-3013	26	
6	HCIP317055	CIP309003.13	VR 808	16	
7	HCIP317062	CIP388615.22	HO 11-8336	36	2
8	HCIP317066	CIP388676.1	VR 808	68	2
9	HCIP317067	CIP309003.13	HO 11-8336	47	4
10	HCIP317071	CIP309121.6	BIJ 11- 17	15	
11	HCIP317072	CIP392820.1	BIJ 11- 17	29	4
12	HCIP317078	CIP309121.6	HO 11-8336	31	2
13	HCIP317079	CIP309129.11	HO 11-8336	41	4
14	HCIP317084	CIP397077.16	HOM 13-8226	40	1
15	HCIP317089	CIP304369.22	BIJ 11- 17	20	
16	HCIP317092	CIP397079.6	HOM 13-8236	46	8
17	HCIP317097	CIP390478.9	VR 808	48	
18	HCIP317098	CIP304387.39	HO 11-8336	54	3
19	HCIP317099	CIP304387.39	BIJ 11- 17	19	1
20	HCIP317103	CIP304387.31	HO 11-8336	52	2
21	HCIP317105	CIP397077.16	VR 808	47	2
22	HCIP317106	CIP397079.6	VR 808	58	5
23	HCIP317108	CIP398208.670	HOM 13-8236	52	7
24	HCIP317111	CIP304406.31	HOM 13-8236	42	8
25	HCIP317116	CIP392820.1	HOM 13-8236	50	2
26	HCIP317118	CIP388676.1	BIJ 11- 17	60	3
27	HCIP317119	CIP390478.9	BIJ 11- 17	11	
28	HCIP317120	CIP388676.1	HO 11-8336	63	5
29	HCIP317122	CIP392820.1	HO 11-8336	44	2
30	HCIP317126	CIP388615.22	HOM 13-8236	65	8
31	HCIP317127	CIP390478.9	HO 11-8336	69	4
32	HCIP317128	CIP390478.9	HOM 13-8236	40	5
33	HCIP317129	CIP397006.18	HO 11-8336	43	2
34	HCIP317131	CIP397077.16	HO 11-8336	13	2
35	HCIP317134	CIP398201.510	HO 11-8336	33	7
36	HCIP317137	CIP309093.43	VR 808	34	1
37	HCIP317152	CIP309043.123	HO 11-8336	66	9
38	HCIP317154	CIP309050.36	HO 11-8336	84	5
39	HCIP317157	CIP397079.6	HO 11-8336	36	6
40	HCIP317161	CIP304371.20	HO 11-8336	39	2
41	HCIP317162	CIP304406.31	HO 11-8336	44	2
42	HCIP317165	CIP309129.11	VR 808	80	1
43	HCIP317169	CIP398208.620	HO 11-8336	64	8
44	HCIP317170	CIP397006.18	HOM 13-8226	43	7
45	HCIP317173	CIP397079.6	HOM 14-8046	25	2
46	HCIP317175	CIP309043.123	HOM 13-8236	47	10
47	HCIP317176	CIP309093.43	HOM 13-8236	52	8
48	HCIP317177	CIP309129.11	HOM 13-8236	68	9
49	HCIP317178	CIP388676.1	HOM 13-8236	84	11
50	HCIP317179	CIP398180.292	HOM 13-8236	50	4

Sr no	Clone	Female	Male	Dalat Feb 19	Dalat Dec 19
51	HCIP317180	CIP398208.620	HOM 13-8236	45	13
52	HCIP317181	CIP398208.505	VR 808	38	1
53	HCIP317185	CIP304369.22	HOM 13-8226	19	4
54	HCIP317187	CIP304371.67	HO 11-8336	29	2
55	HCIP317191	CIP304387.39	HOM 13-8226	8	
56	HCIP317195	CIP390478.9	HOM 13-8226	14	2
57	HCIP317198	CIP397079.6	HOM 13-8226	31	8
58	HCIP317205	CIP398208.670	HOM 13-8226	10	1
59	HCIP317209	CIP398208.505	HO 11-8336	47	12
60	HCIP317212	CIP388615.22	HOM 13-8226	35	4
61	HCIP317213	CIP388676.1	HOM 13-8226	35	5
62	HCIP317215	CIP309103.85	VR 808	55	3
63	HCIP317216	CIP392820.1	VR 808	56	4
64	HCIP317217	CIP304371.67	VR 808	36	9
65	HCIP317218	CIP304349.25	HO 11-8336	39	2
66	HCIP317219	CIP309103.85	HO 11-8336	39	8
67	HCIP317220	CIP304349.25	VR 808	53	1
68	HCIP317221	CIP304371.20	VR 808	30	1
69	HCIP317222	CIP388615.22	VR 808	65	3
70	HCIP317223	CIP397006.18	VR 808	50	3
71	HCIP317224	CIP398201.510	VR 808	44	4
72	HCIP317225	CIP304349.25	HOM 13-8236	52	3
73	HCIP317226	CIP304371.20	HOM 13-8236	32	1
74	HCIP317227	CIP304387.39	HOM 13-8236	37	4
75	HCIP317228	CIP309076.59	HOM 13-8236	62	14
76	HCIP317229	CIP309121.6	HOM 13-8236	60	5
77	HCIP317230	CIP397006.18	HOM 13-8236	50	15
78	HCIP317231	CIP397077.16	HOM 13-8236	39	9
79	HCIP317232	CIP398208.670	VR 808	30	2
80	HCIP317240	CIP309043.123	VR 808	41	2
81	HCIP317241	CIP397006.18	BIJ 11- 17	45	2
82	HCIP317244	CIP398208.670	HO 11-8336	43	5
83	HCIP317245	CIP304387.39	VR 808	37	1
	Total			**3590**	**368**

ANNEX 9. SHORTLISTED PROMISING ADVANCED CLONES BASED ON THE FIELD AND LAB TESTING

Altitude	Fresh	Processing
Highland	HCIP316027.101	HCIP316045.103
	HCIP316069.204	HCIP316079.206
	HCIP316121.108	VR01-1-2
	HCIP316056.220	
	VR08-1-3-147	
Both (HL+ LL)	HCIP316056.103	
	HCIP316140.210	
	HCIP316140.214	
Lowland	HCIP316056.103	
	HCIP316140.214	

ANNEX 10. GROWTH TRAITS OF THE EVALUATED CLONES AT FARMERS' FIELDS IN HAI PHONG (NOVEMBER 2018–FEBRUARY 2019)

Sr no.	Genotype	Plant vigour	Senescence	Plant growth habit	Leaf type
1	HCIP316056.103	7	5	1	2
2	HCIP316069.204	5	7	3	3
3	HCIP316132.106	5	5	3	2
4	HCIP316140.210	5	5	2	2
5	HCIP316140.214	7	5	2	2
6	HCIP316147.109	3	5	3	2
7	HCIP316163.101	3	5	3	2
8	Atlantic	5	7	3	2
9	Marabel	5	7	3	2
10	Solara	5	7	3	3

ANNEX 11. TUBERS TRAITS OF THE EVALUATED CLONES AT FARMERS' FIELDS IN HAL PHONG (NOVEMBER 2018–FEBRUARY 2019)

Sr no.	Genotype	Tuber skin colour	Tuber flesh colour	Tuber shape	Tuber eye depth	Tuber appearance	Tuber uniformity	Tuber Size
1	HCIP316056.103	2	3	2	3	7	7	7
2	HCIP316069.204	2	3	3	3	7	7	7
3	HCIP316132.106	2	4	4	3	5	7	7
4	HCIP316140.210	1	2	2	3	7	7	7
5	HCIP316140.214	2	4	4	3	7	7	7
6	HCIP316147.109	2	3	3	3	5, 7	5	5
7	HCIP316163.101	1	2	2	3	5	5	7
8	Atlantic	1	1	2	3	7	7	7
9	Marabel	2	4	4	3	5	5	5
10	Solara	2	4	4	3	3,5,7	3,5,7	3,5,7

ANNEX 12. YIELD AND RELATED TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN HAI PHONG EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019

Sr no.	Genotype	No. of marketable tubers/ plant	Total tubers/ plant	Marketable tuber weight/ plant (kg)	Marketable tuber yield (t/ha)	Average of marketable tuber weight (g)	Average of tuber weight (g)	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)
1	HCIP316056.103	5.20	8.10	0.820	41.0	155.8	115.4	0.942	47.1
2	HCIP316069.204	4.33	8.22	0.533	26.7	122.5	89.8	0.731	36.5
3	HCIP316132.106	3.10	5.24	0.315	15.8	104.0	81.1	0.407	20.4
4	HCIP316140.210	3.92	7.08	0.673	33.7	174.1	118.7	0.807	40.3
5	HCIP316140.214	3.83	6.42	0.558	27.9	151.2	103.2	0.659	33.0
6	HCIP316147.109	3.38	4.82	0.290	14.5	85.5	67.7	0.347	17.4
7	HCIP316163.101	2.12	5.12	0.227	11.3	106.9	64.2	0.337	16.8
8	Atlantic	3.83	7.30	0.581	29.0	152.6	97.7	0.713	35.6
9	Marabel	5.60	9.60	0.575	28.8	103.0	74.9	0.717	35.9
10	Solara	5.23	11.3	0.601	30.1	114.9	75.9	0.848	42.4
	SD	0.862	1.85	0.165	8.23	26.4	17.0	0.189	9.44
	Variance	0.744	3.42	0.027	67.7	696.5	287.9	0.036	89.0
	SE	0.648	0.920	0.089	4.44	12.9	9.24	0.106	5.28
	CD	1.93	2.73	0.264	13.2	38.3	27.4	0.314	15.7
	CV (%)	27.7	21.8	29.7	29.7	17.6	18.0	28.1	28.1

ANNEX 13. PERFORMANCE OF SELECTED CLONES FOR DM AND REDUCING SUGAR AT FARMERS' FIELDS IN HAI PHONG EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019

Sr no.	Genotype	Dry matter (%)	Reducing sugar (%)
1	HCIP316056.103	22.2	0.360
2	HCIP316069.204	16.9	0.300
3	HCIP316132.106	17.6	0.280
4	HCIP316140.210	16.1	0.310
5	HCIP316140.214	18.6	0.430
6	HCIP316147.109	15.1	0.260
7	HCIP316163.101	17.5	0.400
8	Atlantic	23.3	0.310
9	Marabel	19.3	0.400
10	Solara	21.0	0.390

ANNEX 14. GROWTH TRAITS OF THE EVALUATED CLONES AT FARMERS' FIELDS IN HAI PHONG FROM NOVEMBER 2018 TO FEBRUARY 2019

Sr no.	Genotypes	Plant vigour	Senescence at 75 days	Plant growth habit	Leaf type
1	HCIP316132.207	5	7	3	2
2	HCIP316009.203	5	7	3	2
3	HCIP316034.105	5	5	3	2
4	HCIP316174.201	7	5	2	2
5	HCIP316056.205	5	5	2	3
6	HCIP316056.222	5	7	2	2
7	HCIP316144.108	5	5	2	2
8	HCIP316140.203	5	7	3	2
9	HCIP316102.208	7	7	3	3
10	HCIP316041.205	7	7	3	2
11	HCIP316116.103	5	5	1	2
12	HCIP316040.204	5	7	3	2
13	HCIP316172.202	5	7	3	2
14	HCIP316116.102	5	7	2	3
15	HCIP316041.203	7	7	2	2
16	HCIP316170.202	3	5	2	1
17	Atlantic	5	7	3	2
18	Marabel	5	7	3	2
19	Solara	5	7	3	3

ANNEX 15. TUBER TRAITS OF THE EVALUATED CLONES AT FARMERS' FIELDS IN HAI PHONG (NOVEMBER 2018–FEBRUARY 2019)

Sr no.	Genotype	Tuber skin colour	Tuber flesh colour	Tuber shape	Tuber eye depth	Tuber appearance	Tuber uniformity	Tuber Size
1	HCIP316132.207	2	4	2	3	5	5	7
2	HCIP316009.203	1	4	2	3	5	5	7
3	HCIP316034.105	2	3	2	3	5	5	7
4	HCIP316174.201	1	2	4	3	7	7	7
5	HCIP316056.205	1	4	2	3	5	7	7
6	HCIP316056.222	1	2	2	3	5	7	7
7	HCIP316144.108	1	2	4	3	7	7	7
8	HCIP316140.203	1	3	4	5	5	7	7
9	HCIP316102.208	2	4	2	3	7	5	5
10	HCIP316041.205	2	4	4	3	5	7	5
11	HCIP316116.103	1	3	2	3	5	3	7
12	HCIP316040.204							
13	HCIP316172.202	1	4	2	3	5	5	5
14	HCIP316116.102	1	3	2	3	5	7	7
15	HCIP316041.203	2	4	6	3	5	7	7
16	HCIP316170.202	2	4	4	3	7	7	5
17	Atlantic	1	1	2	3	7	7	7
18	Marabel	2	4	4	3,4,5	5	5	5
19	Solara	2	4	4	3	3,5,7	3,5,7	3,5,7

ANNEX 16. YIELD AND RELATED TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN HAI PHONG EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019

Genotype	No. of marketable tubers/plant	Total tuber number/plant	Marketable tuber weight/plant	Market tuber yield	Average of marketable tuber weight (g)	Average of tuber weight (g)	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)
HCIP316132.207	5.00	7.50	0.600	30.0	120.0	94.0	0.705	35.3
HCIP316009.203	3.67	4.33	0.453	22.7	123.6	107.7	0.467	23.3
HCIP316034.105	3.50	7.25	0.416	20.8	118.9	69.1	0.501	25.1
HCIP316174.201	6.50	7.75	0.750	37.5	115.4	100.6	0.780	39.0
HCIP316056.205	10.33	11.70	1.830	91.3	176.8	159.4	1.860	93.0
HCIP316056.222	6.00	7.50	0.975	48.8	162.5	136.0	1.020	51.0
HCIP316144.108	7.50	8.50	1.030	51.3	136.7	124.1	1.060	52.8
HCIP316140.203	5.75	6.25	1.360	67.8	235.7	218.8	1.370	68.4
HCIP316102.208	8.25	10.00	0.800	40.0	97.0	82.5	0.825	41.3
HCIP316041.205	5.60	8.60	0.740	37.0	132.1	96.7	0.832	41.6
HCIP316116.103	3.75	6.25	0.475	23.8	126.7	84.8	0.530	26.5
HCIP316040.204	7.50	7.50	1.350	67.5	180.0	180.0	1.350	67.5
HCIP316172.202	3.25	6.00	0.400	20.0	123.1	83.3	0.500	25.0
HCIP316116.102	5.33	6.67	0.833	41.7	156.3	137.0	0.913	45.7
HCIP316041.203	6.75	13.80	0.740	37.0	109.6	73.8	1.020	50.8
HCIP316170.202	5.80	8.40	0.664	33.2	114.5	91.4	0.768	38.4
Atlantic	3.83	7.30	0.581	29.0	152.6	97.7	0.713	35.6
Marabel	5.60	9.60	0.575	28.8	103.0	74.9	0.717	35.9
Solara	5.23	11.3	0.601	30.1	114.9	75.9	0.848	42.4

ANNEX 17. PERFORMANCE OF SELECTED CLONES FOR PROCESSING AND RELATED TRAITS AT FARMERS' FIELDS IN HAI PHONG EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019

Sr.no	Genotype	Dry matter (%)	Reducing sugar (%)
1	HCIP316132.207	16.4	0.340
2	HCIP316009.203	18.8	0.400
3	HCIP316034.105	21.2	0.350
4	HCIP316174.201	20.6	0.430
5	HCIP316056.205	19.5	0.350
6	HCIP316056.222	19.7	0.360
7	HCIP316144.108	20.7	0.350
8	HCIP316140.203	15.2	0.350
9	HCIP316102.208	19.1	0.380
10	HCIP316041.205	21.3	0.340
11	HCIP316116.103	20.0	0.400
12	HCIP316040.204		
13	HCIP316172.202	19.2	0.460
14	HCIP316116.102	17.6	0.450
15	HCIP316041.203	18.9	0.340
16	HCIP316170.202	17.0	0.360
17	Atlantic	23.3	0.310
18	Marabel	19.4	0.390
19	Solara	21.2	0.380

ANNEX 18. LIST OF CLONES PLANTED EARLIER AND LATER THAN THE NORMAL PLANTING IN CHUONG MY

No.	Early planting	Late planting
1	HCIP316045.103	HCIP316040.204
2	HCIP316056.103	HCIP316140.214
3	HCIP316069.204	HCIP316069.204
4	HCIP316079.206	VR01-1-47
5	HCIP316121.108	LB 44-1-4-5
6	HCIP316140.210	Atlantic
7	HCIP316140.214	Marabel
8	VR01-1-2	Solara
9	Atlantic	
10	Marabel	
11	Solara	

ANNEX 19. GROWTH TRAITS OF THE EVALUATED CLONES AT FARMERS' FIELDS IN DALAT (NOVEMBER 2018–FEBRUARY 2019)

Sr no.	Genotype	Plant vigour	Senescence at 75 days	Plant growth habit	Leaf type
1	CIP314950.8	7	5	2	3
2	CIP314953.2	9	5	1	3
3	CIP314965.39	7	5	3	3
4	HCIP316027.101	7	5	2	3
5	HCIP316045.103	7	7	3	3
6	HCIP316056.103	5	5	2	3
7	HCIP316056.220	7	7	2	3
8	HCIP316069.204	7	7	2	3
9	HCIP316079.203	9	3, 5, 7	1	3
10	HCIP316079.206	5	5	2	3
11	HCIP316121.108	7	5	1	3
12	HCIP316132.106	7	5	2	3
13	HCIP316136.101	9	5	2	3
14	HCIP316140.210	9	5	1	3
15	HCIP316140.214	7	5	3	3
16	HCIP316147.109	5, 7, 9	5	3	3
17	CIP316163.101	5	5	3	2
18	Atlantic	7	9	2	3
19	O7	5	7	2	3
20	PO3	7	5	2	2

ANNEX 20. TUBER TRAITS OF THE EVALUATED CLONES AT FARMERS' FIELDS IN DALAT (NOVEMBER 2018–FEBRUARY 2019)

Sr no.	Genotype	Tuber skin colour	Tuber flesh colour	Tuber shape	Tuber eye depth	Tuber appearance	Tuber uniformity	Tuber Size
1	CIP314950.8	1	1	2	1	5	5	7
2	CIP314953.2	1	1	2	1	5	5	5
3	CIP314965.39	1	1	4	1	5	5	7
4	HCIP316027.101	2	4	4	1	7	7	7
5	HCIP316045.103	1	1	4	1	7	7	7
6	HCIP316056.103	2	3	2	1	7	7	7
7	HCIP316056.220	1	1	4	1	7	7	7
8	HCIP316069.204	2	4	4	1	7	7	7
9	HCIP316079.203	1	1	2	1	5	7	7
10	HCIP316079.206	2	4	2	1	7	7	7
11	HCIP316121.108	1	1	2	1	7	5	7
12	HCIP316132.106	2	4	4	1	5	7	5
13	HCIP316136.101	1	2	4	1	7	7	7
14	HCIP316140.210	1	1	2	1	5	5	7
15	HCIP316140.214	2	4	4	1	5	5	5
16	HCIP316147.109	2	3	4	1	7	5	7
17	HCIP316163.101	1	1	2	1	5	7	7
18	Atlantic	1	1	2	1	5	5	5
19	O7	6	4	2	1	5	5	5
20	PO3	1	3	2	1	5	5	7

Annex 21. YIELD AND RELATED TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019

Sr no.	Genotype	No of marketable tubers/ plant	Total tubers/ plant	Marketable tuber weight/ plant (kg)	Marketable tuber yield (t/ha)	Average of marketable tuber weight (g)	Average of tuber weight (g)	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)
1	CIP314950.8	6.91	12.7	0.781	39.1	112.4	74.6	0.951	47.6
2	CIP314953.2	4.30	7.10	0.480	24.0	111.7	79.9	0.569	28.5
3	CIP314965.39	3.40	5.60	0.562	28.1	163.2	109.1	0.615	30.7
4	HCIP316027.101	4.47	5.97	0.891	44.6	218.1	177.9	0.961	48.0
5	HCIP316045.103	4.07	6.73	0.490	24.5	136.1	108.7	0.595	29.8
6	HCIP316056.103	6.19	10.20	0.779	39.0	132.0	91.0	0.917	45.8
7	HCIP316056.220	4.15	6.27	0.590	29.5	141.3	106.9	0.667	33.3
8	HCIP316069.204	7.29	10.6	0.973	48.7	137.0	104.6	1.080	53.9
9	HCIP316079.203	5.19	7.90	0.886	44.3	173.3	127.5	0.990	49.5
10	HCIP316079.206	5.97	9.12	0.622	31.1	104.8	77.8	0.708	35.4
11	HCIP316121.108	3.77	5.71	0.900	45.0	240.0	175.7	0.988	49.4
12	HCIP316132.106	4.17	8.11	0.373	18.7	87.0	61.7	0.498	24.9
13	HCIP316136.101	5.05	7.25	0.922	46.1	183.7	134.3	0.967	48.3
14	HCIP316140.210	5.89	9.40	0.802	40.1	133.8	99.2	0.944	47.2
15	HCIP316140.214	4.75	9.53	0.543	27.2	114.3	73.7	0.704	35.2
16	HCIP316147.109	4.99	8.58	0.604	30.2	121.3	84.7	0.728	36.4
17	HCIP316163.101	3.85	5.33	0.611	30.6	165.5	127.3	0.672	33.6
18	Atlantic	2.73	5.03	0.242	12.1	84.6	69.5	0.380	19.0
19	O7	3.76	10.9	0.343	17.1	92.3	55.2	0.599	30.0
20	PO3	3.74	4.93	0.435	21.8	115.2	97.2	0.477	23.8
	SD	0.931	1.85	0.187	9.37	37.2	29.9	0.167	8.35
	Variance	0.867	3.42	0.035	87.8	1380.8	894.6	0.028	69.7
	SE	0.757	1.24	0.105	5.24	19.0	15.9	0.121	6.07
	CD	2.17	3.55	0.300	15.0	54.3	45.4	0.348	17.4
	CV (%)	27.7	27.4	28.3	28.3	23.7	27.0	28.0	28.0

Annex 22. Performance of Selected Clones for Processing and Related Traits at Farmers' Fields in Dalat Evaluated from November 2018 to February 2019

Sr no.	Genotype	Dry matter (%)	Reducing sugar (%)	Chips Colour	French Fry Score	Boiling/ Flavour
1	CIP314950.8			2.00	2.21	4.92
2	CIP314953.2	23.6	0.290	1.93	1.50	4.08
3	CIP314965.39	20.3	0.360	1.93	1.86	3.92
4	HCIP316027.101	17.3	0.290	2.14	2.14	4.46
5	HCIP316045.103	19.6	0.400	1.29	1.36	3.85
6	HCIP316056.103	20.7	0.290	1.57	1.79	4.77
7	HCIP316056.220	21.3	0.190	2.29	2.14	4.77
8	HCIP316069.204	19.9	0.330	2.21	2.07	3.92
9	HCIP316079.203	18.3	0.410	2.36	3.29	4.62
10	HCIP316079.206	22.8	0.380	2.00	2.43	4.54
11	HCIP316121.108	21.6	0.160	2.00	1.86	4.15
12	HCIP316132.106	18.6	0.390	1.79	1.64	4.15
13	HCIP316136.101	19.6	0.430	2.50	2.57	4.31
14	HCIP316140.210	17.3	0.440	2.86	2.86	5.23
15	HCIP316140.214	16.6	0.430	2.93	2.79	4.77
16	HCIP316147.109	18.6	0.360	2.21	2.00	4.54
17	HCIP316163.101	21.5	0.400	2.57	2.36	4.38
18	Atlantic	23.9	0.385	1.21	1.21	2.85
19	O7			2.00	2.07	3.31
20	PO3			1.71	1.64	3.62

Annex 23. Performance of Selected Clones for Yield and Related Traits at Farmers' Fields in Dalat Evaluated from September 2019 to December 2019

	Genotype	Total number of tubers/ plant	Number of marketable tubers/ plant	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)	Marketable tuber weight/ plant (kg)	Marketable tuber yield (t/ha)	Average of tuber weight (g)	Av mkt tuber wt (g)	LB In field
1	HCIP316027.101	9.16	2.65	0.659	33.0	0.402	20.1	72.3	149.9	2
2	HCIP316045.103	4.79	0.916	0.306	15.3	0.141	7.03	59.6	134.4	6
3	HCIP316056.103	3.68	0.306	0.144	7.20	0.031	1.53	39.2	100.0	5
4	HCIP316056.220	6.23	2.21	0.486	24.3	0.335	16.7	80.4	152.6	2
5	HCIP316069.204	8.27	2.28	0.519	26.0	0.272	13.6	63.5	119.1	2
6	HCIP316079.203	5.91	2.85	0.580	29.0	0.448	22.4	96.7	155.6	2
7	HCIP316079.206	8.38	3.19	0.718	35.9	0.483	24.2	87.8	152.5	1
8	HCIP316121.108	7.17	1.67	0.410	20.5	0.230	11.5	57.0	138.4	2
9	HCIP316136.101	3.71	0.039	0.081	4.07	0.004	0.196	22.1	100.0	6
10	HCIP316140.210	8.29	2.75	0.668	33.4	0.449	22.4	82.5	163.4	2
11	HCIP316140.214	3.55	0.05	0.076	3.81	0.005	0.238	21.1	100.0	6
12	HCIP316147.109	4.59	0.00	0.135	6.73	0.0	0.0	29.3		6
13	ALT	3.89	0.00	0.104	5.19	0.0	0.0	26.7		6
14	O7	5.18	1.29	0.286	14.3	0.119	5.95	56.2	93.3	4
15	PO3	4.11	0.208	0.137	6.84	0.021	1.04	38.8	100.0	5
	SD	1.86	1.19	0.229	11.5	0.183	9.14	2.39E+01		
	Variance	3.45	1.41	0.053	131.3	0.033	83.6	5.71E+02		
	SE	0.970	0.421	0.095	4.76	0.071	3.53	10.7		
	CD	2.80	1.21	0.274	13.7	0.203	10.2	30.9		
	CV (%)	21.7	33.7	28.7	28.7	40.6	40.6	23.9		

ANNEX 24. DNA ANALYSIS AND FIELD PERFORMANCE OF THE SELECTED CLONES

	Genotype	M3 blight	M7 PCN	M8 blight	M21 blight	M27 PVY	LB in field
1	HCIP316027.101	1	1	0	0	0	2
2	HCIP316045.103	0	1	0	0	1	6
3	HCIP316056.103	0	1	0	0	1	5
4	HCIP316056.220	1	1	0	0	1	2
5	HCIP316069.204	1	0	0	0	1	2
6	HCIP316079.203	1	1	0	0	1	2
7	HCIP316079.206	1	1	0	0	1	1
8	HCIP316121.108	1	1	0	0	1	2
9	HCIP316136.101	0	0	0	0	0	6
10	HCIP316140.210	1	1	0	0	1	2
11	HCIP316140.214	0	0	0	0	0	6
12	HCIP316147.109	0	0	0	0	0	6

DNA ANALYSIS: 0= RESISTANCE ABSENT, 1=RESISTANCE PRESENT; FIELD TESTING: 1=EXTREMELY RESISTANT, 6= HIGHLY SUSCEPTIBLE

ANNEX 25. GROWTH TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (MARCH–JUNE 2019; 10T/REP) FROM TRIAL 1

Sr no.	Genotype	Plant vigour	Senescence at 75 days	Leaf type
1	HCIP316140.214	7		2
2	HCIP316041.205	7	3	3
3	HCIP316009.203	9	3	3
4	Atlantic	7		2
5	O7	7	5	2
6	PO3	7	5	2

ANNEX 26. TUBER TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (MARCH–JUNE 2019; 10T/REP) FROM TRIAL 1

Sr no.	Genotype	Tuber skin colour	Tuber flesh colour	Tuber shape	Tuber eye depth	Tuber appearance	Tuber uniformity	Tuber Size
1	HCIP316140.214	1	4	3	3	5	7	7
2	HCIP316041.205	2	4	3	3	7	7	9
3	HCIP316009.203	1	4	2	3	7	7	9
4	Atlantic	1	2	2	3	5	7	7
5	O7	6	4	3	5	7	7	9
6	PO3	1	3	3	3	5	5	7

ANNEX 27. YIELD AND RELATED OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (MARCH–JUNE 2019; 10T/REP) FROM TRIAL 1

Sr no.	Genotype	No of marketable tubers/ plant	Total tubers/ plant	Marketable tuber weight/ plant (kg)	Marketable tuber yield (t/ha)	Average of marketable tuber weight (g)	Average of tuber weight (g)	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)
1	HCIP316140.214	0.19	7.78	0.014	0.723	79.2	30.0	0.228	11.4
2	HCIP316041.205	3.35	6.69	0.534	26.7	159.0	103.7	0.685	34.3
3	HCIP316009.203	4.38	9.46	0.579	29.0	132.9	88.6	0.816	40.8
4	Atlantic	1.24	4.33	0.107	5.36	86.3	52.1	0.209	10.5
5	O7	3.32	5.71	0.551	27.5	166.0	120.1	0.675	33.8
6	PO3	0.96	4.83	0.138	6.88	148.9	54.8	0.267	13.3
	SD	1.64	1.68	0.257	12.9	35.6	33.7	0.270	13.5
	Variance	2.69	2.82	0.066	165.7	1269.2	1137.6	0.073	181.8
	SE	0.274	1.00	0.038	1.88	11.3	8.31	0.051	2.55
	CD	0.865	3.16	0.118	5.91	35.5	26.2	0.161	8.03
	CV (%)	21.2	26.9	20.3	20.3	15.2	19.2	18.4	18.4

ANNEX 28. PERFORMANCE OF SELECTED CLONES FOR PROCESSING AND RELATED TRAITS OF THE SELECTED CLONES FROM TRIAL 1

Sr no.	Genotype	Chips Colour	French Fry	Boiling/Flavour
1	HCIP316140.214	4.25	3.25	4.29
2	HCIP316041.205	2.06	2.31	3.29
3	HCIP316009.203	2.13	2.75	3.86
4	Atlantic	1.13	2.13	4.29
5	O7	2.88	3.13	2.57
6	PO3	1.13	1.13	2.57

ANNEX 29. GROWTH TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (MARCH–JUNE 2019; 5T/REP) FROM TRIAL 2

Sr no.	Genotype	Plant vigour	Senescence at 75 days	Leaf type
1	HCIP316056.222	9	3	3
2	HCIP316116.103	7		2
3	HCIP316041.203	9	7	3
4	HCIP316034.105	7	7	1
5	HCIP316040.204	7	5,7	2
6	Atlantic	died	died	died
7	PO3	7	5	2
8	O7	7	5	2

ANNEX 30. TUBER TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (MARCH–JUNE 2019; 5T/REP) FROM TRIAL 2

Sr no.	Genotype	Tuber skin colour	Tuber flesh colour	Tuber shape	Tuber eye depth	Tuber appearance	Tuber uniformity	Tuber Size
1	HCIP316056.222	1	2	2	3	5	7	9
2	HCIP316116.103	1	2	2	3	5	7	5
3	HCIP316041.203	1	2	3	3	5	7	7
4	HCIP316034.105	1	3	2	3	5	7	7
5	HCIP316040.204	2	4	2	3	7	5	7
6	Atlantic	1	2	2	3	3,5,7	7	5
7	PO3	2	3	3	3	5	5	7
8	O7	6	4	3	3	5	5	7

ANNEX 31. YIELD AND RELATED TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (MARCH–JUNE 2019; 5T/REP) FROM TRIAL 2

Sr no.	Genotype	No of marketable tubers/ plant	Total tubers/ plant	Marketable tuber weight/ plant (kg)	Marketable tuber yield (t/ha)	Average of marketable tuber weight (g)	Average of tuber weight (g)	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)
1	HCIP316056.222	3.22	7.19	0.678	33.9	213.1	112.6	0.777	38.9
2	HCIP316116.103	1.92	7.33	0.146	7.3	80.5	37.4	0.279	14.0
3	HCIP316041.203	5.39	11.70	0.550	27.5	103.3	63.8	0.750	37.5
4	HCIP316034.105	2.83	7.17	0.213	10.6	72.9	44.3	0.325	16.3
5	HCIP316040.204	4.13	8.31	0.493	24.7	120.6	84.0	0.657	32.8
6	Atlantic	2.08	5.78	0.146	7.3	65.0	51.6	0.306	15.3
7	PO3	1.39	6.06	0.111	5.6	80.0	40.1	0.228	11.4
8	O7	3.00	4.81	0.336	16.8	112.0	78.7	0.378	18.9
	SD	1.19	1.79	0.21	10.5	46.2	24.7	0.221	11.0
	Variance	1.41	3.21	0.044	110.4	2137.5	610.5	0.049	121.7
	SE	0.508	1.05	0.048	2.42	11.2	8.97	0.051	2.53
	CD	1.54	3.19	0.147	7.35	33.9	27.2	0.153	7.67
	CV (%)	29.4	25.0	25.1	25.1	18.3	24.3	19.0	19.0

ANNEX 32. PERFORMANCE OF SELECTED CLONES FOR PROCESSING AND RELATED TRAITS IN DALAT (MARCH–JUNE 2019) FROM TRIAL 2

Sr no.	Genotype	Chips Colour	French Fry	Boiling/Flavour
1	HCIP316056.222	2.75	3.38	4.57
2	HCIP316116.103			
3	HCIP316041.203	2.06	2.31	3.29
4	HCIP316034.105			
5	HCIP316040.204	2.75	3.50	4.29
6	Atlantic	1.13	2.13	4.29
7	PO3	1.13	1.13	2.57
8	O7	2.88	3.13	2.57

ANNEX 33. GROWTH TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (MARCH–JUNE 2019) (UNREPLICATED TRIAL)

Sr no.	Genotype	Plant vigour	Senescence at 75 days	Leaf type
1	HCIP316056.205	7		2
2	HCIP316056.226	7		2
3	HCIP316102.208	7	5	2
4	HCIP316116.102	9	5	3
5	HCIP316144.108	7	3	2
6	HCIP316170.202	9	5	3
7	HCIP316 099.108	9	3	3
8	HCIP316 121.202	7	3	2
9	HCIP316 132.205	7	5	2
10	HCIP316 056.202	9	5	3

ANNEX 34. TUBER TRAITS OF THE EVALUATED CLONES AT FARMERS' FIELDS IN DALAT (MARCH–JUNE 2019) (UNREPLICATED TRIAL)

Sr no.	Genotype	Tuber skin colour	Tuber flesh colour	Tuber shape	Tuber eye depth
1	HCIP316056.205	1	3	3	3
2	HCIP316056.226	1	1	2	3
3	HCIP316102.208	1	2	2	3
4	HCIP316116.102	1	3	2	5
5	HCIP316144.108	1	2	2	5
6	HCIP316170.202	1	3	2	5

ANNEX 35. YIELD AND RELATED TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (MARCH–JUNE 2019) (UNREPLICATED TRIAL)

Sr no.	Genotype	No of marketable tubers/ plant	Total tubers/ plant	Marketable tuber weight/ plant (kg	Marketable tuber yield (t/ha)	Average of marketable tuber weight (g)	Average of tuber weight (g)	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)
1	HCIP316056.205	1.33	4.00	0.100	5.00	75.0	37.5	0.150	7.50
2	HCIP316056.226	-	10.7	-	-	-	21.9	0.233	11.7
3	HCIP316102.208	-	6.36	-	-	-	27.0	0.177	8.83
4	HCIP316116.102	5.50	5.50	0.900	45.0	163.6	163.6	0.900	45.0
5	HCIP316144.108	1.75	5.25	0.225	11.3	128.6	66.7	0.350	17.5
6	HCIP316170.202	6.33	12.3	0.700	35.0	110.5	78.4	0.967	48.3

ANNEX 36. PERFORMANCE OF SELECTED CLONES FOR DM EVALUATED AT FARMERS' FIELDS IN DALAT (MARCH–JUNE 2019) (UNREPLICATED TRIAL)

Sr no.	Genotype	Dry matter (%)
1	HCIP316102.208	16.8
2	HCIP316144.108	18.0
3	HCIP316170.202	16.6
4	HCIP316099.108	15.8
5	HCIP316121.202	15.6
6	HCIP316132.205	17.6
7	HCIP316056.202	18.3

ANNEX 37. GROWTH TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN HAI PHONG (NOVEMBER 2018–FEBRUARY 2019) (REPLICATED TRIAL)

Sr no.	Genotype	Plant vigour	Senescence at 75 days	Plant growth habit	Leaf type
1	HCIP316040.4	5	5	2	2
2	HCIP316040.6	5	5	3	2
3	HCIP316040.7	5	5	3	3
4	HCIP316054.2	5	5	2	2
5	HCIP316121.1	5	5	2	2
6	HCIP316121.3	5	5	2	2
7	HCIP316132.4	5	5	3	2
8	HCIP316132.5	3	5	3	1
9	HCIP316170.1	5	5	2	2
10	Atlantic	5	5	3	3
11	Marabel	5	7	2	2
12	Solara	5	5	3	3

ANNEX 38. TUBER TRAITS OF THE EVALUATED CLONES AT FARMERS' FIELDS IN HAI PHONG (NOVEMBER 2018–FEBRUARY 2019) (REPLICATED TRIAL)

Sr no.	Genotype	Tuber skin colour	Tuber flesh colour	Tuber shape	Tuber eye depth	Tuber appearance	Tuber uniformity	Tuber Size
1	HCIP316040.4	2	4	4	5	7	7	7
2	HCIP316040.6	2	2	3	5	5	3	7
3	HCIP316040.7	2	2	7	5	5	5	7
4	HCIP316054.2	1	3	7	5	5	7	7
5	HCIP316121.1	1	3	2	5	7	7	7
6	HCIP316121.3	2	2	3	5	5	5	5
7	HCIP316132.4	2	2	4	5	7	7	7
8	HCIP316132.5	2	1	2	5	5	7	7
9	HCIP316170.1	2	2	5	5	5	5	7
10	Atlantic	2	1	2	5	5	7	7
11	Marabel	2	4	5	7	7	7	7
12	Solara	2	4	4	5	7	5	5

ANNEX 39. YIELD AND RELATED TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN HAI PHONG (NOVEMBER 2018–FEBRUARY 2019) (REPLICATED TRIAL)

Sr no.	Genotype	No of marketable tubers/ plant	Total tubers/ plant	Marketable tuber weight/ plant (kg)	Marketable tuber yield (t/ha)	Average of marketable tuber weight (g)	Average of tuber weight (g)	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)
1	HCIP316040.4	4.74	6.63	0.681	34.1	143.9	116.2	0.769	38.5
2	HCIP316040.6	3.85	6.07	0.561	28.1	147.7	106.7	0.650	32.5
3	HCIP316040.7	5.53	6.75	0.618	30.9	114.7	102.0	0.677	33.8
4	HCIP316054.2	6.00	10.2	0.863	43.1	143.8	95.5	0.969	48.4
5	HCIP316121.1	4.40	7.13	0.538	26.9	124.1	94.0	0.641	32.1
6	HCIP316121.3	2.80	5.73	0.256	12.8	85.1	55.7	0.342	17.1
7	HCIP316132.4	3.53	5.83	0.603	30.2	173.0	117.4	0.666	33.3
8	HCIP316132.5	3.17	4.58	0.356	17.8	98.6	73.9	0.386	19.3
9	HCIP316170.1	4.93	6.65	0.788	39.4	161.9	127.7	0.841	42.1
10	Atlantic	4.27	6.47	0.493	24.7	122.9	89.5	0.567	28.3
11	Marabel	5.07	7.07	0.655	32.8	127.6	100.6	0.725	36.3
12	Solara	6.20	9.67	0.695	34.7	111.7	85.0	0.818	40.9
	SD	0.859	1.24	0.144	7.19	22.3	16.7	0.149	7.47
	Variance	0.738	1.55	0.021	51.7	499.3	279.6	0.022	55.7
	SE	0.656	0.966	0.090	4.52	12.5	10.9	0.099	4.96
	CD	1.92	2.83	0.265	13.3	36.7	32.1	0.290	14.5
	CV (%)	25.0	24.3	26.4	26.4	16.7	19.6	25.6	25.6

ANNEX 40. PERFORMANCE OF THE SELECTED CLONES FOR PROCESSING TRAITS AT FARMERS' FIELDS IN HAI PHONG EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019 (REPLICATED TRIAL)

Sr no.	Genotype	Dry matter (%)	Reducing sugar (%)
1	HCIP316040.4	20.3	0.310
2	HCIP316040.6	20.8	0.330
3	HCIP316040.7	18.2	0.310
4	HCIP316054.2	18.0	0.330
5	HCIP316121.1	23.5	0.300
6	HCIP316121.3	20.2	0.340
7	HCIP316132.4	16.2	0.340
8	HCIP316132.5	16.2	0.340
9	HCIP316170.1	19.1	0.340
10	Atlantic	23.5	0.310
11	Marabel	19.3	0.390
12	Solara	21.1	0.360

ANNEX 41. GROWTH TRAITS OF THE EVALUATED CLONES AT FARMERS' FIELDS IN HAI PHONG EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019 (NONREPLICATED TRIAL)

Sr no.	Genotype	Plant vigour	Senescence at 75 days	Plant growth habit	Leaf type
1	HCIP316073.3	5	5	2	2
2	HCIP316174.7	5	5	2	2
3	HCIP316140.9	5	5	3	2
4	HCIP316147.2	5	7	2	1
5	HCIP316175.1	5	5	3	2
6	HCIP316040.5	3	5	2	2

ANNEX 42. YIELD AND RELATED TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN HAI PHONG EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019 (NONREPLICATED TRIAL)

Sr no.	Genotype	No of marketable tubers/ plant	Total tubers/ plant	Marketable tuber weight/ plant (kg)	Marketable tuber yield (t/ha)	Average of marketable tuber weight (g)	Average of tuber weight (g)	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)
1	HCIP316073.3	3.60	7.60	0.490	24.5	136.1	85.5	0.650	32.5
2	HCIP316174.7	-	1.75	-	-	-	21.4	0.038	1.88
3	HCIP316140.9	3.67	6.67	0.513	25.7	140.0	89.0	0.593	29.7
4	HCIP316147.2	4.60	7.60	0.596	29.8	129.6	91.6	0.696	34.8
5	HCIP316175.1	4.60	6.60	0.624	31.2	135.7	102.4	0.676	33.8
6	HCIP316040.5	4.78	7.56	0.598	29.0	125.1	89.7	0.678	32.9

ANNEX 43. DM AND REDUCING SUGAR OF THE SELECTED CLONES AT FARMERS' FIELDS IN HAI PHONG EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019 (NONREPLICATED TRIAL)

Sr no.	Genotype	Dry matter (%)	Reducing Sugar (%)
1	HCIP316073.3	24.2	0.43
2	HCIP316174.7	20.2	0.35
3	HCIP316140.9	22.3	0.44
4	HCIP316147.2	19.2	0.31
5	HCIP316175.1	15.0	0.33
6	HCIP316040.5	20.9	0.39

ANNEX 44. GROWTH TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (NOVEMBER 2018–FEBRUARY 2019) FROM TRIAL 1

Sr no.	Genotype	Plant vigour	Senescence at 75 days	Plant growth habit	Leaf type
1	HCIP316007.1	9	5	3	3
2	HCIP316009.5	9	5	3	3
3	HCIP316014.1	7	5	2	2
4	HCIP316014.2	7	5	3	3
5	HCIP316040.4	7	5	3	3
6	HCIP316040.6	7	7	3	2
7	HCIP316040.7	7	5	3	3
8	HCIP316049.3	5	7	3	2
9	HCIP316121.1	7, 9	5	2	3
10	HCIP316132.4	5	5	3	3
11	HCIP316132.7	5, 7	5	3	3
12	HCIP316147.3	9	5	2	3
13	HCIP316147.4	7	5	2	3
14	HCIP316163.4	7	5	2	2
15	HCIP316174.4	7	5	3	2
16	Atlantic	7	7	2	3
17	O7	5	7	2	2
18	P03	7	5	2	2

ANNEX 45. TUBER TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (NOVEMBER 2018–FEBRUARY 2019) FROM TRIAL 1

Sr no.	Genotype	Tuber skin colour	Tuber flesh colour	Tuber shape	Tuber eye depth	Tuber appearance	Tuber uniformity	Tuber Size
1	HCIP316007.1	1	3	4	3	7	7	7
2	HCIP316009.5	1	4	4	1	7	7	7
3	HCIP316014.1	1	3	2	2	5	7	5
4	HCIP316014.2	1	4	4	1	7	7	7
5	HCIP316040.4	2	4	2	2	7	7	7
6	HCIP316040.6	2	3	2	2	7	7	7
7	HCIP316040.7	2	3	4	1	7	7	7
8	HCIP316049.3	1	2	2	1	7	7	7
9	HCIP316121.1	2	4	2	1	7	7	7
10	HCIP316132.4	1	2	2	1	5	5	7
11	HCIP316132.7	1	1	2	1	7	7	7
12	HCIP316147.3	1	4	2	1	7	7	7
13	HCIP316147.4	1	3	2	1	7	7	7
14	HCIP316163.4	1	3	2	1	7	7	7
15	HCIP316174.4	1	1	2	1	7	7	7
16	Atlantic	1	1	2	3	5	7	5
17	O7	6	3	2	1	5	5	5
18	P03	2	4	2	1	7	7	7

ANNEX 46. YIELD AND RELATED TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (NOVEMBER 2018–FEBRUARY 2019) FROM TRIAL 1

Sr no.	Genotype	No of marketable tubers/ plant	Total tubers/ plant	Marketable tuber weight/ plant (kg)	Marketable tuber yield (t/ha)	Average of marketable tuber weight (g)	Average of tuber weight (g)	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)
1	HCIP316007.1	3.42	5.17	0.863	43.1	255.5	181.3	0.938	46.9
2	HCIP316009.5	4.67	6.73	0.657	32.8	143.2	111.6	0.719	35.9
3	HCIP316014.1	4.50	7.42	0.538	26.9	119.0	85.0	0.631	31.6
4	HCIP316014.2	6.67	9.08	1.010	50.6	151.4	119.4	1.090	54.4
5	HCIP316040.4	5.98	8.70	0.827	41.3	135.9	103.4	0.912	45.6
6	HCIP316040.6	3.05	4.32	0.535	26.8	174.7	133.1	0.578	28.9
7	HCIP316040.7	6.88	9.17	1.020	50.8	148.4	118.9	1.090	54.4
8	HCIP316049.3	3.89	5.00	0.465	23.3	128.8	97.7	0.488	24.4
9	HCIP316121.1	6.63	10.0	0.778	38.9	117.4	83.6	0.836	41.8
10	HCIP316132.4	3.53	7.33	0.340	17.0	96.5	60.7	0.445	22.3
11	HCIP316132.7	5.85	9.37	1.080	54.2	185.2	127.6	1.190	59.7
12	HCIP316147.3	4.53	6.73	0.805	40.3	177.4	130.1	0.880	44.0
13	HCIP316147.4	5.60	6.93	0.845	42.3	151.7	129.9	0.900	45.0
14	HCIP316163.4	5.02	6.32	0.843	42.2	170.7	142.0	0.887	44.3
15	HCIP316174.4	4.37	6.39	0.480	24.0	109.9	85.4	0.543	27.2
16	Atlantic	3.61	7.22	0.296	14.8	79.2	61.1	0.450	22.5
17	O7	2.82	8.19	0.210	10.5	76.8	47.8	0.384	19.2
18	P03	4.92	6.67	0.610	30.5	122.9	100.3	0.681	34.0
	SD	1.18	1.47	0.247	12.4	41.5	32.1	0.233	11.7
	Variance	1.38	2.16	0.061	152.6	1724.4	1030.5	0.054	136.1
	SE	0.484	0.613	0.077	3.83	10.3	8.04	0.078	3.9
	CD	1.39	1.76	0.220	11.0	29.6	23.1	0.224	11.2
	CV (%)	17.6	14.6	19.6	19.6	12.6	13.1	17.9	17.9

ANNEX 47. PERFORMANCE OF SELECTED CLONES FOR PROCESSING AND RELATED TRAITS AT FARMERS' FIELDS IN DALAT EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019 FROM TRIAL 1

Sr no.	Genotype	Dry matter (%)	Reducing sugar (%)	Chips Colour	French Fry	Boiling/Flavour
1	HCIP316007.1	22.5	0.200			
2	HCIP316009.5	19.1	0.240			
3	HCIP316014.1	22.5	0.380	1.14	1.43	3.46
4	HCIP316014.2	22.0	0.210			
5	HCIP316040.4	17.6	0.340			
6	HCIP316040.6	19.8	0.300			
7	HCIP316040.7	17.0	0.270			
8	HCIP316049.3	21.0	0.350	1.64	2.07	5.00
9	HCIP316121.1	21.0	0.280	1.57	1.79	3.31
10	HCIP316132.4	18.7	0.350	2.64	2.43	4.92
11	HCIP316132.7	15.5	0.230			
12	HCIP316147.3	19.9	0.255			
13	HCIP316147.4	19.5	0.275			
14	HCIP316163.4					
15	HCIP316174.4	24.9	0.340	1.64	1.93	4.15
16	Atlantic	21.5	0.170	1.21	1.21	2.85
17	O7	20.0	0.295	2.00	2.07	3.31
18	P03	22.6	0.300	1.71	1.64	3.62

ANNEX 48. GROWTH TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (NOVEMBER 2018–FEBRUARY 2019) FROM TRIAL 2

Sr no.	Genotype	Plant vigour	Senescence at 75 days	Plant growth habit	Leaf type
1	HCIP316009.2	7	5	3	3
2	HCIP316041.1	9	7	3	3
3	HCIP316063.4	7	5	3	3
4	HCIP316103.2	7	5	1	3
5	HCIP316132.5	5	5	3	2
6	HCIP316140.5	7	5	3	3
7	HCIP316140.9	7	5	3	3
8	HCIP316147.1	7	5	2, 3	3
9	Atlantic	7	7	2	3
10	O7	5	7	2	2
11	PO3	7	5	2	3

ANNEX 49. TUBER TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (NOVEMBER 2018–FEBRUARY 2019) FROM TRIAL 2

Sr no.	Genotype	Tuber skin colour	Tuber flesh colour	Tuber shape	Tuber eye depth	Tuber appearance	Tuber uniformity	Tuber Size
1	HCIP316009.2	1	1	2	1	7	7	7
2	HCIP316041.1	2	3	4	1	7	7	7
3	HCIP316063.4	2	4	3	1	7	7	7
4	HCIP316103.2	1	1	2	1	5	5	7
5	HCIP316132.5	1	2	2	1	7	5	5
6	HCIP316140.5	1	1	2	1	5	5	5
7	HCIP316140.9	2	3	4	3	7	7	7
8	HCIP316147.1	2	4	4	1	7	7	7
9	Atlantic	1	1	2	1	5	7	5
10	O7	3	4	2	1	5	5	5
11	PO3	1	3	3	1	5	5	7

ANNEX 50. YIELD AND RELATED TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT SELECTED FROM NOVEMBER 2018 TO FEBRUARY 2019 FROM TRIAL 2

Sr no.	Genotype	No. of marketable tubers/ plant	Total tubers/ plant	Marketable tuber weight/ plant (kg)	Marketable tuber yield (t/ha)	Average of marketable tuber weight (g)	Average of tuber weight (g)	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)
1	HCIP316009.2	6.22	8.03	1.06	53.0	168.0	135.6	1.10	54.8
2	HCIP316041.1	6.67	12.1	0.653	32.6	96.5	67.2	0.820	41.0
3	HCIP316063.4	4.00	6.92	0.638	31.9	158.2	112.9	0.775	38.8
4	HCIP316103.2	2.88	6.83	0.273	13.7	96.0	57.5	0.396	19.8
5	HCIP316132.5	4.10	7.10	0.412	20.6	100.2	68.5	0.487	24.3
6	HCIP316140.5	3.50	6.92	0.413	20.6	119.7	73.8	0.513	25.6
7	HCIP316140.9	2.63	4.92	0.491	24.5	207.7	129.6	0.566	28.3
8	HCIP316147.1	3.53	6.73	0.480	24.0	135.8	84.7	0.570	28.5
9	Atlantic	1.67	4.77	0.158	7.88	97.5	53.0	0.248	12.4
10	O7	1.38	7.98	0.089	4.44	63.9	31.7	0.252	12.6
11	PO3	3.80	5.85	0.423	21.2	111.4	83.5	0.489	24.5
	SD	1.54	1.79	0.252	12.6	37.5	30.0	0.239	11.9
	Variance	2.37	3.20	0.063	158.2	1409.4	900.1	0.057	142.5
	SE	0.563	0.824	0.082	4.10	16.6	12.4	0.078	3.92
	CD	1.66	2.43	0.242	12.1	49.1	36.6	0.231	11.6
	CV (%)	26.6	20.1	30.7	30.7	23.4	26.3	24.1	24.1

ANNEX 51. PERFORMANCE OF SELECTED CLONES FOR PROCESSING AND RELATED TRAITS AT FARMERS' FIELDS IN DALAT EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019 FROM TRIAL 2

Sr no.	Genotype	Dry matter (%)	Reducing sugar (%)	Chips Colour	French Fry Score	Boiling/ Flavour
1	HCIP316009.2	17.1	0.300			
2	HCIP316041.1	22.2	0.360			
3	HCIP316063.4	15.0	0.350			
4	HCIP316103.2	19.7	0.370	2.86	2.57	5.00
5	HCIP316132.5	21.4	0.310	1.57	2.07	4.77
6	HCIP316140.5	20.4	0.310	2.36	2.43	5.46
7	HCIP316140.9	18.5	0.340			
8	HCIP316147.1	20.4	0.250			
9	Atlantic	21.5	0.170	1.21	1.21	2.85
10	O7			2.00	2.07	3.31
11	PO3			1.71	1.64	3.62

ANNEX 52. GROWTH TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (NOVEMBER 2018–FEBRUARY 2019) FROM TRIAL 3 (NONREPLICATED)

Sr no.	Genotype	Plant vigour	Senescence at 75 days	Plant growth habit	Leaf type
1	HCIP316063.2	7	5	3	3
2	HCIP316170.5	7	7	3	3
3	HCIP316140.4	5	5	3	2
4	HCIP316169.6	5	7	1	3
5	HCIP316140.8	7	7	3	3
6	HCIP316177.4	7	7	3	3
7	HCIP316136.3	5	5	3	2
8	HCIP316063.1	7	5	3	2
9	HCIP316074.1	7	5	2	3
10	HCIP316050.2	7	7	3	3
11	HCIP316078.106	9	5	1	3
12	HCIP316079.2	7	5	1	3
13	HCIP316172.4	7	5	1	3
14	HCIP316121.3	5	5	2	3
15	HCIP316147.2	9	5	2	3
16	HCIP316054.2	7	5	2	3
17	HCIP316175.3	7	5	2	3
18	HCIP316174.7	9	5	3	3
19	HCIP316173.3	9	5	2	3
20	HCIP316039.1	5	5	2	3

ANNEX 53. TUBER TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (NOVEMBER 2018–FEBRUARY 2019) FROM TRIAL 3 (NONREPLICATED)

Sr no.	Genotype	Tuber skin colour	Tuber flesh colour	Tuber shape	Tuber eye depth	Tuber appearance	Tuber uniformity	Tuber Size
1	HCIP316063.2	1		2		5	7	7
2	HCIP316170.5	1	1	2		5	7	5
3	HCIP316140.4	1	3	2		7	7	7
4	HCIP316169.6	1	2	2		7	7	7
5	HCIP316140.8	1	1	4	2	5	5	7
6	HCIP316177.4	1	1	4	2	5	5	5
7	HCIP316136.3	1		6	1	5	5	7
8	HCIP316063.1	2	3	1	3	7		
9	HCIP316074.1	1	1	2	1	5	5	7
10	HCIP316050.2	1	2	4	2	7	7	7
11	HCIP316078.106	2	3	4	2	5	7	7
12	HCIP316079.2	2	4	4	1	7	5	7
13	HCIP316172.4	1	1	3	2	5	7	7
14	HCIP316121.3	1	1	2	1	5	5	7
15	HCIP316147.2	2	3	4	2	7	7	7
16	HCIP316054.2	1	1	4	1	5	5	7
17	HCIP316175.3	2	3	4	1	7	7	5
18	HCIP316174.7	2	4	3	2	7	7	7
19	HCIP316173.3	2	3	4	3	7	5	7
20	HCIP316039.1	2	4	6	2	7	7	7

ANNEX 54. YIELD AND RELATED TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (NOVEMBER 2018–FEBRUARY 2019) FROM TRIAL 3 (NONREPLICATED)

Sr no.	Genotype	No. of marketable tubers/ plant	Total tubers/ plant	Marketable tuber weight/ plant (kg)	Marketable tuber yield (t/ha)	Average of marketable tuber weight (g)	Average of tuber weight (g)	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)
1	HCIP316063.2	4.00	6.00	0.600	30.0	150.0	116.7	0.700	35.0
2	HCIP316170.5	6.75	10.8	0.613	30.6	90.7	66.3	0.713	35.6
3	HCIP316140.4	4.80	6.00	0.730	36.5	152.1	128.3	0.770	38.5
4	HCIP316169.6	6.50	7.00	0.613	30.6	94.2	89.3	0.625	31.3
5	HCIP316140.8	3.25	4.00	0.588	29.4	180.8	150.6	0.603	30.1
6	HCIP316177.4	3.20	5.60	0.360	18.0	112.5	80.4	0.450	22.5
7	HCIP316136.3	1.60	2.20	0.320	16.0	200.0	150.0	0.330	16.5
8	HCIP316063.1	4.80	4.80	0.560	28.0	116.7	116.7	0.560	28.0
9	HCIP316074.1	3.60	7.80	0.360	18.0	100.0	69.2	0.540	27.0
10	HCIP316050.2	5.80	9.80	0.800	40.0	137.9	100.0	0.980	49.0
11	HCIP316078.106	4.43	6.71	0.829	41.4	187.1	138.3	0.929	46.4
12	HCIP316079.2	1.75	3.00	0.125	6.25	71.4	50.0	0.150	7.50
13	HCIP316172.4	3.80	6.20	0.460	23.0	121.1	87.1	0.540	27.0
14	HCIP316121.3	2.75	8.75	0.325	16.3	118.2	48.6	0.425	21.3
15	HCIP316147.2	5.00	6.80	0.740	37.0	148.0	117.6	0.800	40.0
16	HCIP316054.2	4.00	8.25	0.400	20.0	100.0	60.6	0.500	25.0
17	HCIP316175.3	5.75	11.5	0.450	22.5	78.3	50.0	0.575	28.8
18	HCIP316174.7	4.40	5.20	0.580	29.0	131.8	117.3	0.610	30.5
19	HCIP316173.3	2.60	5.60	0.420	21.0	161.5	96.4	0.540	27.0
20	HCIP316039.1	7.25	9.75	0.850	42.5	117.2	92.3	0.900	45.0

ANNEX 55. PROCESSING AND RELATED TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT (NOVEMBER 2018–FEBRUARY 2019) FROM TRIAL 3 (NONREPLICATED)

Sr no.	Genotype	Dry matter (%)	Reducing sugar (%)	Chip colour	French Fry
1	HCIP316063.2	20.8	0.36		
2	HCIP316170.5	19.1	0.33	2.14	2.14
3	HCIP316140.4	21.7	0.29		
4	HCIP316169.6	22.7	0.36		
5	HCIP316140.8	17.9	0.28		
6	HCIP316177.4	17.0	0.35	2.57	2.29
7	HCIP316136.3	18.0	0.36		
8	HCIP316063.1	21.0	0.3		
9	HCIP316074.1	19.2	0.31	1.57	2.29
10	HCIP316050.2	19.1	0.25		
11	HCIP316078.106	18.8	0.39	2.86	2.43
12	HCIP316079.2	23.7	0.38		
13	HCIP316172.4	21.4	0.38		
14	HCIP316121.3	18.7	0.31		
15	HCIP316147.2	20.9	0.33		
16	HCIP316054.2	17.5	0.31		
17	HCIP316175.3	22.0	0.41		
18	HCIP316174.7	23.2	0.38		
19	HCIP316173.3	22.5	0.35		
20	HCIP316039.1	21.9	0.29		

ANNEX 56. PERFORMANCE OF SELECTED CLONES STAGE IN DALAT HARVESTED IN DECEMBER 2019

Genotype	Total no. of tubers/ plant	No. of marketable tubers/ plant	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)	Marketable tuber weight/ plant (kg)	Marketable tuber yield (t/ha)	Average of tuber weight (g)	Average of marketable tuber weight (g)	LB in Field
HCIP316009.2	6.44	4.15	0.937	46.9	0.814	40.7	144.9	196.9	2
HCIP316040.7	8.30	4.22	0.905	45.3	0.682	34.1	108.1	162.8	2
HCIP316041.1	6.44	2.54	0.511	25.6	0.353	17.7	78.0	136.7	2
HCIP316049.3	5.64	3.01	0.673	33.6	0.543	27.2	120.3	177.5	3
HCIP316063.2	11.35	3.75	0.921	46.0	0.596	29.8	80.8	158.7	2
HCIP316063.4	7.14	2.58	0.498	24.9	0.352	17.6	69.7	137.3	3
HCIP316132.5	8.86	2.50	0.651	32.6	0.429	21.4	73.4	170.6	2
HCIP316140.5	7.21	2.76	0.627	31.4	0.404	20.2	86.1	144.0	2
Atlantic	3.28	0.351	0.110	5.51	0.028	1.39	33.7	82.4	6
O7	5.92	1.43	0.289	14.4	0.124	6.20	48.8	87.6	6
PO3	5.37	0.609	0.175	8.77	0.047	2.34	32.3	86.1	6
SD	2.04	1.25	0.281	14.0	0.246	12.3	34.2	37.3	
Variance	4.17	1.57	0.079	196.8	0.060	150.7	1167.7	1391.6	
SE	0.513	0.349	0.080	4.00	0.075	3.77	7.60	12.4	
CD	1.51	1.03	0.236	11.8	0.222	11.1	22.4	36.7	
CV (%)	12.9	23.8	24.2	24.2	32.8	32.8	16.5	15.4	

ANNEX 57. GROWTH TRAITS OF THE CIP ADVANCED CLONES AT FARMERS' FIELDS IN HAI PHONG (NOVEMBER 2018–FEBRUARY 2019)

Sr no.	Genotype	Plant vigour	Plant uniformity	Plant growth habit
1	CIP393708.31	7	7	2
2	LB44-1-4-5	7	7	2
3	VR08-1-3-147	7	7	2
4	VR01-1-2	7	7	2
5	VR01-1-47	7	7	1
6	VR01-5-3	7	7	2
7	Atlantic	7	7	2
8	Marabel	7	7	2
9	Solara	7	7	2

ANNEX 58. TUBER TRAITS OF THE EVALUATED CLONES AT FARMERS' FIELDS IN HAI PHONG (NOVEMBER 2018–FEBRUARY 2019)

Sr no.	Genotype	Tuber skin colour	Tuber flesh colour	Tuber eye depth
1	CIP393708.31	2	1	3
2	LB44-1-4-5	2	1	3
3	VR01-1-2	2	1	5
4	VR01-1-47	2	1	3
5	VR01-5-3	2	4	3
6	VR08-1-3-147	2	1	5
7	Atlantic	2	1	5
8	Marabel	2	4	3
9	Solara	2	4	3

ANNEX 59. YIELD AND RELATED TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN HAI PHONG EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019

Sr no.	Genotype	No. of marketable tubers/ plant	Total tubers/ plant	Marketable tuber weight/ plant (kg)	Marketable tuber yield (t/ha)	Average of marketable tuber weight (g)	Average of tuber weight (g)	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)
1	CIP393708.31	3.90	6.28	0.495	24.8	127.9	95.5	0.575	28.8
2	LB44-1-4-5	4.12	7.92	0.523	26.1	127.6	87.4	0.686	34.3
3	VR01-1-2	4.55	10.80	0.580	29.0	127.6	69.1	0.746	37.3
4	VR01-1-47	5.24	11.30	0.585	29.3	111.8	69.0	0.781	39.0
5	VR01-5-3	3.74	9.04	0.428	21.4	115.1	66.7	0.603	30.1
6	VR08-1-3-147	5.10	9.58	0.672	33.6	134.1	86.9	0.829	41.5
7	Atlantic	4.31	7.26	0.572	28.6	133.3	94.9	0.689	34.4
8	Marabel	5.28	9.04	0.621	31.1	118.2	82.9	0.750	37.5
9	Solara	4.39	8.77	0.435	21.7	100.0	67.0	0.584	29.2
	SD	0.479	1.49	0.078	3.89	9.89	10.9	0.086	4.28
	Variance	0.230	2.21	0.006	15.1	97.8	119.1	0.007	18.3
	SE	0.318	0.61	0.027	1.37	5.49	5.13	0.032	1.61
	CD	0.954	1.81	0.082	4.12	16.4	15.4	0.097	4.83
	CV (%)	12.2	11.80	8.72	8.72	7.81	11.1	8.04	8.04

ANNEX 60. PERFORMANCE OF SELECTED CLONES FOR PROCESSING AND RELATED TRAITS AT FARMERS' FIELDS IN HAI PHONG EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019

Sr no.	Genotype	Dry matter (%)	Reducing sugar (%)
1	CIP393708.31	23.6	0.29
2	LB44-1-4-5	21.4	0.29
3	VR01-1-2	20.8	0.26
4	VR01-1-47	21.5	0.26
5	VR01-5-3	18.3	0.28
6	VR08-1-3-147	20.9	0.26
7	Atlantic	22.4	0.32
8	Marabel	18.3	0.27
9	Solara	18.3	0.27

ANNEX 61. GROWTH TRAITS OF THE EVALUATED CLONES AT FARMERS' FIELDS IN DALAT (NOVEMBER 2018–FEBRUARY 2019)

Sr no.	Genotype	Plant vigour	Plant uniformity	Senescence at 75 days	Plant growth habit
1	LB44-1-4-5	7	7	3	2
2	VR08-1-3-147	7	7	3	2
3	VR-1-1-2	7	5	5	2
4	VR-1-1-47	9	7	3	2
5	Atlantic	7	7	7	2
6	O7	7	5	7	3
7	PO3	7	7	5	2

ANNEX 62. YIELD AND RELATED TRAITS OF THE SELECTED CLONES AT FARMERS' FIELDS IN DALAT EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019

Sr no.	Genotype	No. of marketable tubers/ plant	Total tubers/ plant	Marketable tuber weight/ plant (kg)	Marketable tuber yield (t/ha)	Average of marketable tuber weight (g)	Average of tuber weight (g)	Total tuber weight/ plant (kg)	Total tuber yield (t/ha)
1	LB44-1-4-5	4.63	9.95	0.437	21.9	94.0	64.2	0.631	31.5
2	VR08-1-3-147	3.41	4.32	0.872	43.6	265.3	223.0	0.929	46.5
3	VR-1-1-2	2.90	3.99	0.478	23.9	166.4	132.8	0.527	26.4
4	VR-1-1-47	3.72	5.98	0.485	24.3	129.7	99.3	0.598	29.9
5	Atlantic	1.53	4.62	0.148	7.39	99.3	54.3	0.250	12.6
6	O7	2.10	6.85	0.189	9.44	90.3	49.2	0.331	16.6
7	PO3	4.32	7.03	0.580	29.0	134.5	97.8	0.686	34.3
	SE	0.374	0.823	0.043	2.16	14.1	10.3	0.057	2.83
	CD	1.15	2.54	0.133	6.66	43.5	31.7	0.174	8.72

ANNEX 63. PERFORMANCE OF SELECTED CLONES FOR PROCESSING AND RELATED TRAITS AT FARMERS' FIELDS IN DALAT EVALUATED FROM NOVEMBER 2018 TO FEBRUARY 2019

Sr no.	Genotype	Dry matter (%)	Reducing sugar (%)	Chips Colour	French Fry	Boiling/ Flavour
1	LB44-1-4-5	19.6	0.330			
2	VR08-1-3-147	21.2	0.340			
3	VR-1-1-2	22.3	0.450	1.64	2.00	3.54
4	VR-1-1-47	20.6	0.300			
5	Atlantic	21.5	0.410	1.21	1.21	2.85
6	O7	20.0	0.330	2.57	2.36	3.31
7	PO3	22.6	0.300	1.79	1.71	3.62

ANNEX 64. DNA ANALYSIS OF SOME OF THE SELECTED CLONES DONE AT LABORATORY IN HZPC, HOLLAND

Sr no.	Genotype	Rpi ber (LB)	Rpi-dms R8 (LB)	Rpi dms R9 (LB)	Rvy-adg	PCN Ro1	TRV
1	CIP 314957.6	0	0	0	1	1	0
2	CIP 314960.13	0	0	0	1	1	0
3	CIP 314968.73	1	0	0	1	0	0
4	CIP 314969.79	0	0	0	0	1	0
5	HCIP316009.202	0	0	0	1	0	1
6	HCIP316009.203	1	0	0	0	1	1
7	HCIP316009.207	0	0	0	1	1	1
8	HCIP316027.106	1	1	0	1	1	1
9	HCIP316027.110	1	0	0	0	1	2
10	HCIP316034.105	0	0	0	0	0	0
11	HCIP316038.101	0	0	0	0	0	0
12	HCIP316040.203	0	0	0	0	1	1
13	HCIP316040.204	1	0	0	1	1	0
14	HCIP316041.202	0	0	0	0	0	0
15	HCIP316041.203	1	0	0	1	0	1
16	HCIP316041.205	1	0	0	1	1	2
17	HCIP316049.202	1	0	0	0	0	1
18	HCIP316055.210	0	0	0	1	0	0
19	HCIP316055.212	0	0	0	1	0	0
20	HCIP316056.202	1	0	0	1	1	1
21	HCIP316056.205	0	0	0	1	0	1
22	HCIP316056.207	1	0	0	1	1	1
23	HCIP316056.201	0	0	0	0	2	1
24	HCIP316056.222	1	0	0	0	1	1
25	HCIP316056.223	0	0	0	0	1	1
26	HCIP316056.226	0	0	0	0	1	1
27	HCIP316063.203	0	0	0	1	1	2
28	HCIP316064.204	0	0	1	0	1	0
29	HCIP316075.205	1	0	0	1	0	0
30	HCIP316095.211	0	0	0	1	0	0
31	HCIP316099.104	1	0	0	1	1	0
32	HCIP316099.108	1	0	0	0	0	2
33	HCIP316102.201	0	0	0	0	0	1
34	HCIP316102.208	0	0	0	1	0	1
35	HCIP316116.102	0	0	0	0	0	1
36	HCIP316116.103	0	0	0	1	0	1
37	HCIP316121.202	1	0	0	1	1	2
38	HCIP316125.203	0	0	0	1	1	0

Sr no.	Genotype	Rpi ber (LB)	Rpi-dms R8 (LB)	Rpi dms R9 (LB)	Rvy-adg	PCN Ro1	TRV
39	HCIP316126.202	0	0	0	1	0	1
40	HCIP316132.205	1	0	0	1	0	2
41	HCIP316140.208	0	0	0	1	0	1
42	HCIP316140.211	1	0	0	1	1	1
43	HCIP316140.214	0	0	0	0	0	0
44	HCIP316144.108	0	0	0	0	1	0
45	HCIP316169.202	0	0	0	0	0	0
46	HCIP316169.205	0	0	0	0	0	0
47	HCIP316170.202	1	0	0	1	0	1
48	HCIP316174.201	0	0	0	0	0	0
49	HCIP316174.202	0	0	0	0	0	0
50	Atlantic	0	0	0	0	1	0
51	O7	0	0	0	1	0	0
52	PO3	0	1	0	0	0	0
53	VR 01-1-2	0	0	0	1	0	0
54	LB 44-1-4-5	0	0	0	1	0	0
55	VR 01-1-47	0	0	0	1	0	0
56	HCIP316172.202	0	0	0	0	0	0

ANNEX 65. RESULTS OF ELISA TESTING DONE AT PVFC OF THE SELECTED MOST ADVANCED CLONES

Genotype	Assigned #	PVX	PLRV	PVY	PVA	PVM	PVS
HCIP316056.103	1	0	0	0	0	0	0
HCIP316056.103	2	0	0	0	0	0	0
HCIP316056.103	3	0	0	0	0	0	0
HCIP316056.103	4	0	0	0	0	0	0
HCIP316056.103	6	0	0	0	0	0	0
HCIP316056.103	7	0	0	0	0	0	0
HCIP316056.103	9	0	0	0	0	0	0
HCIP316056.103	11	0	0	0	0	0	0
HCIP316056.103	12	0	0	0	0	0	0
HCIP316056.103	14	0	0	0	0	0	0
HCIP316056.103	16	0	0	0	0	0	0
HCIP316056.103	17	0	0	0	0	0	0
HCIP316056.103	18	0	0	0	0	0	0
HCIP316140.210	21	0	0	0	0	0	0
HCIP316140.210	23	0	0	0	0	0	0
HCIP316140.210	24	0	0	0	0	0	0
HCIP316140.210	25	0	0	0	0	0	0
HCIP316140.210	26	0	0	0	0	0	0
HCIP316140.210	28	0	0	0	0	×	0
HCIP316140.210	29	0	0	0	0	×	0
HCIP316140.210	30	0	0	0	0	×	0
HCIP316140.210	32	0	0	0	0	×	0
HCIP316140.210	33	0	0	0	0	×	0
HCIP316140.210	34	0	0	0	0	×	0
HCIP316140.210	35	0	0	0	0	×	0
HCIP316140.210	36	0	0	0	0	×	0
HCIP316140.210	37	0	0	0	0	×	0
HCIP316027.101	42	0	0	0	0	0	0
HCIP316027.101	43	0	0	0	0	0	0
HCIP316027.101	44	0	0	0	0	0	0

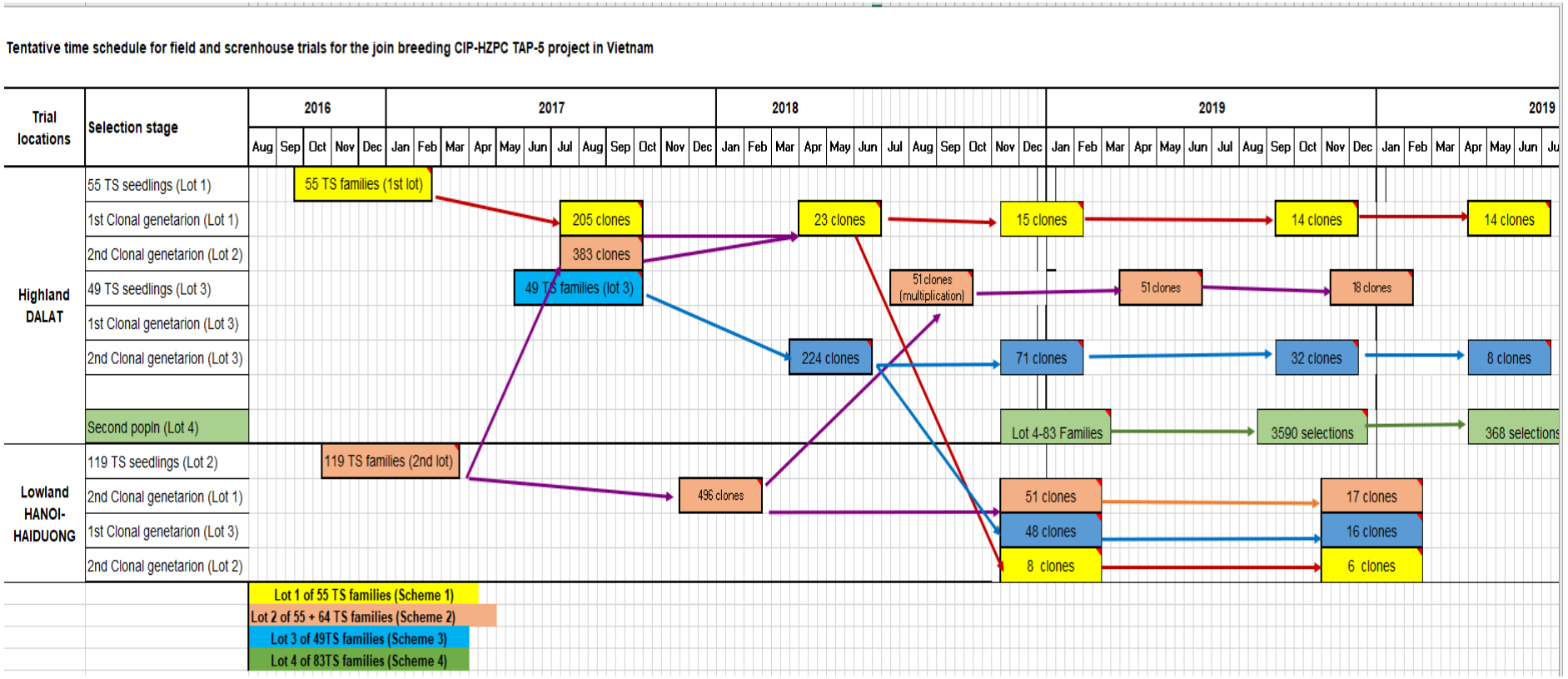
HCIP316027.101	45	0	0	0	0	0	0
HCIP316027.101	46	0	0	0	0	0	0
HCIP316027.101	47	0	0	0	0	0	0
HCIP316027.101	48	0	0	0	0	0	0
HCIP316027.101	49	0	0	0	0	0	0
HCIP316027.101	50	0	0	0	0	0	0
HCIP316027.101	51	0	0	0	0	0	0
HCIP316027.101	52	0	0	0	0	0	0
HCIP316027.101	53	0	0	0	0	0	0
HCIP316027.101	54	0	0	0	0	0	0
HCIP316027.101	55	0	0	0	0	0	0
HCIP316027.101	56	0	0	0	0	0	0
HCIP316027.101	57	0	0	0	0	0	0
HCIP316027.101	58	0	0	0	0	0	0
HCIP316027.101	59	0	0	0	0	0	0
HCIP316027.101	60	0	0	0	0	0	0
HCIP316079.206	61	0	0	0	0	0	0
HCIP316079.206	62	0	0	0	0	0	0
HCIP316079.206	63	0	0	0	0	0	0
HCIP316079.206	64	0	0	0	0	0	0
HCIP316079.206	65	0	0	0	0	0	0
HCIP316079.206	66	0	0	0	0	0	0
HCIP316079.206	67	0	0	0	0	0	0
HCIP316079.206	68	0	0	0	0	0	0
HCIP316079.206	69	0	0	0	0	0	0
HCIP316079.206	70	0	0	0	0	0	0
HCIP316079.206	71	0	0	0	0	0	0
HCIP316079.206	72	0	0	0	0	0	0
HCIP316079.206	73	0	0	0	0	0	0
HCIP316079.206	74	0	0	0	0	0	0
HCIP316079.206	75	0	0	0	0	0	0
HCIP316079.206	76	0	0	0	0	0	0
HCIP316079.206	77	0	0	0	0	0	0
HCIP316079.206	78	0	0	0	0	0	0
HCIP316079.206	79	0	0	0	0	0	0
HCIP316079.206	80	0	0	0	0	0	0
VR01 -1-2	81	0	0	0	0	×	×
VR01 -1-2	82	0	0	0	0	×	×
VR01 -1-2	83	0	×	0	0	×	0
VR01 -1-2	84	0	0	0	0	×	×
VR01 -1-2	85	0	0	0	0	0	x
VR01 -1-2	86	0	x	0	0	0	0
VR01 -1-2	87	0	×	0	0	×	0
VR01 -1-2	88	0	0	0	0	x	x
VR01 -1-2	89	0	0	0	0	×	×
VR01 -1-2	90	0	0	0	0	×	×
VR01 -1-2	91	0	0	0	0	×	×
VR01 -1-2	93	0	×	0	0	×	×
VR01 -1-2	94	0	0	0	0	0	0
VR01 -1-2	95	0	0	0	0	x	x
VR01 -1-2	96	0	0	0	0	×	×
VR01 -1-2	97	0	0	0	0	×	×
VR01 -1-2	98	0	0	0	0	×	0
VR01 -1-2	99	0	0	0	0	0	0

VR01 -1-2	100	0	0	0	0	0	0
HCIP316069.204	101	0	0	0	0	0	0
HCIP316069.204	102	0	0	0	0	0	0
HCIP316121.108	103	0	0	0	0	0	0
HCIP316121.108	104	0	0	0	0	0	0
HCIP316140.214	105	0	0	0	0	0	0
HCIP316140.214	106	0	0	0	0	0	0
HCIP316056.220	107	0	0	0	0	0	0
HCIP316056.220	108	0	0	0	0	0	0
VR08-1-3-147	109	×	0	0	0	×	0
VR08-1-3-147	110	×	0	0	0	×	0
VR08-1-3-147	153	x	0	0	0	x	0
VR08-1-3-147	154	x	0	0	0	x	0
VR08-1-3-147	155	x	0	0	0	0	0
VR08-1-3-147	157	x	0	0	0	x	0
VR08-1-3-147	159	x	0	0	0	0	0
HCIP316045.103	111	0	0	0	0	0	0
HCIP316045.103	112	0	0	0	0	0	0

ANNEX 66. SCALE USED FOR MEASURING QUALITATIVE TRAITS AND DISEASE RESISTANCE

Senescence	1=very late, 3=late, 5 = medium, 7 =early, 9= Very early
Plant growth habit	1= erect, 2= semi-erect, 3 = Decumbent, 4 = Prostrate, 5 = Semi-rosette, 6 = Rosette
Leaf type	1= ugly, 2=acceptable, 3= very good
Plant vigour	1= very weak, 3=weak, 5 = medium, 7 = vigorous, 9 = very vigorous
Tuber appearance	1= very poor, 3= poor, 5= regular, 7= good, 9= very good
Tuber uniformity	1= very heterogeneous, 3= heterogeneous, 5= intermediate, 7=uniform, 9= very uniform
Tuber size	1=very small (<2cm), 3=small (2-4cm), 5=medium (4-6cm), 7=large (6-9 cm), 9= very large (over 9 cm)
Tuber shape	1= Compressed, 2= Rounded, 3= Ovoid, 4= Obovioid,5= Eliptical,6= Oblong, 7= Long-oblong,8= Elongated
Predominant tuber skin colour	1=white-cream, 2=yellow, 3=orange, 4=brownish, 5 = Pink, 6 = Red, 7 = Purplish-red, 8 = Purple, 9 = Blackish
Tuber flesh colour	1 = White, 2=cream, 3=pale yellow, 4=yellow, 5 = Intense Yellow, 6 = Red,7 = Purple, 8 = Violet
Tuber eyes depth	1 = Protruding, 3= shallow, 5=slightly deep, 7= deep, 9= very deep
Chips colour	1= Light, 2= Moderately light, 3= Moderately dark, 4= Dark, 5= Very dark
French Fry	1= Light, 2= Moderately light, 3= Moderately dark, 4= Dark, 5= Very dark
Flavour (Boiling)	1= best, 3=good, 5= interim, 7= poor 9= poorest
Late blight	1 = Extreme Resistance (ER), 2 = Resistant (R), 3 = Moderately Resistant (MR), 4 = Moderately susceptible (MS), 5 = Susceptible (S), 6 = Highly Susceptible (HS)
DNA Analysis	0= Resistance Absent, 1= Resistant present

ANNEX 67. UPDATED GANTT CHART



ANNEX 68. PROJECT PHOTOS

Crossing program for BW population

Berries of the successful crosses

Selected clones in the farmer field trial

Selected advanced clones

Local checks Atlantic and PO3 from field trials in Dalat

Chips of one of the selected clone VR01-1-2 and check variety Atlantic

Chips and French Fries of some of the selected clones from Set 3

Early planted trial in Chuong My for heat tolerance

Observations on pests in Chuong My trial

Observations recording in Chuong My trial

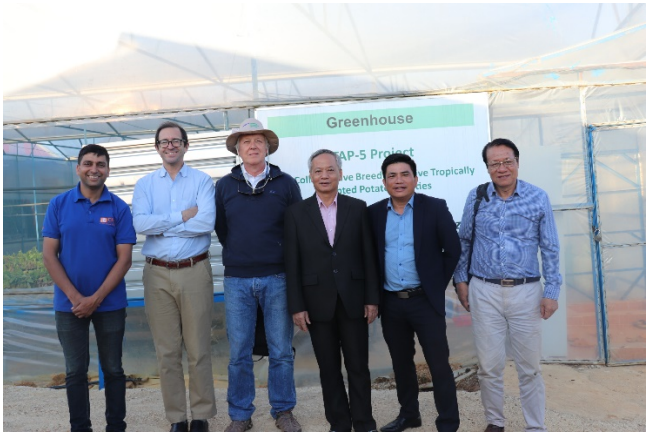
Planting of trial in Hai Phong at farmer field

Planting of trial in Hai Phong at farmer field

Seed treatment of trial in Hai Phong

Harvesting and selections in Dalat during Feb, 2020

Selection in screenhouse at Dalat



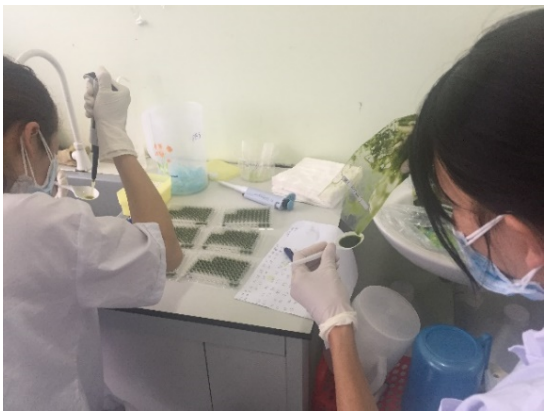
The team with Dr Dinh at TAP-5 screenhouse

Harvesting and selection in Dalat

Evaluation of processing traits in Dalat

Visit of TAP-5 team to Hai Phong Trials in December

DNA samples ready to be shipped to HZPC



ELISA testing of advanced clones

Visit of stakeholders in screenhouse in Dalat

TAP-5 team in Dalat making selections

Host farmer of trials in Dalat

Visit of farmer field trials in Dalat near airport

Annual review meeting in Dalat during February, 2019

Meeting with Dr Dinh, DDG, DCP in CIP Hanoi office

Meeting with SFSA team in CIP Hanoi office

Drafting product launch plan with marketing experts

Discussion among stakeholders after harvesting

The International Potato Center (known by its Spanish acronym CIP) is a research-for-development organization with a focus on potato, sweetpotato, and Andean roots and tubers. CIP is dedicated to delivering sustainable science-based solutions to the pressing world issues of hunger, poverty, gender equity, climate change, and the preservation of our Earth's fragile biodiversity and natural resources.

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