尊敬的会员： 您好

"A Brief Overview of Potato Cultivation in Pakistan, the Population Genetic Structure of *P. infestans*, Possible Control Strategies, and the Work Progress of AsiaBlight"

DR. WAQAS RAZA

Adjunct Scientist & Regional Representative

International Potato Center-China Center for Asia Pacific (CIP-CCCAP), Yanqing Beijing, China

Brief Overview of Talk

- ➢Introduction to potato cultivation in Pakistan
- ➢Key fungicides for PLB control
- ➢Research Work on PLB in Pakistan
- ➢Research Work at Nanjing Agricultural University
- ➢AsiaBlight Project: Overview of Research Work
- ➢Future plans

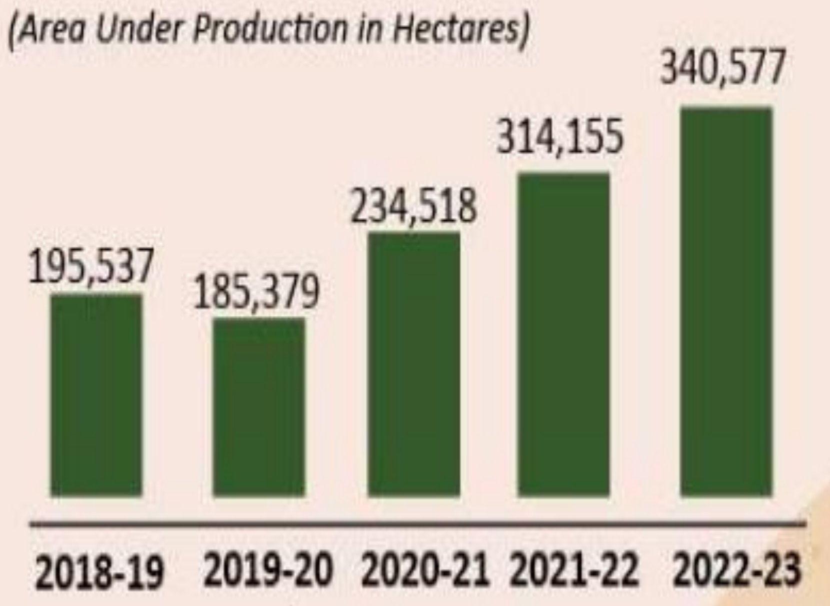
PAKISTAN AT A GLANCE

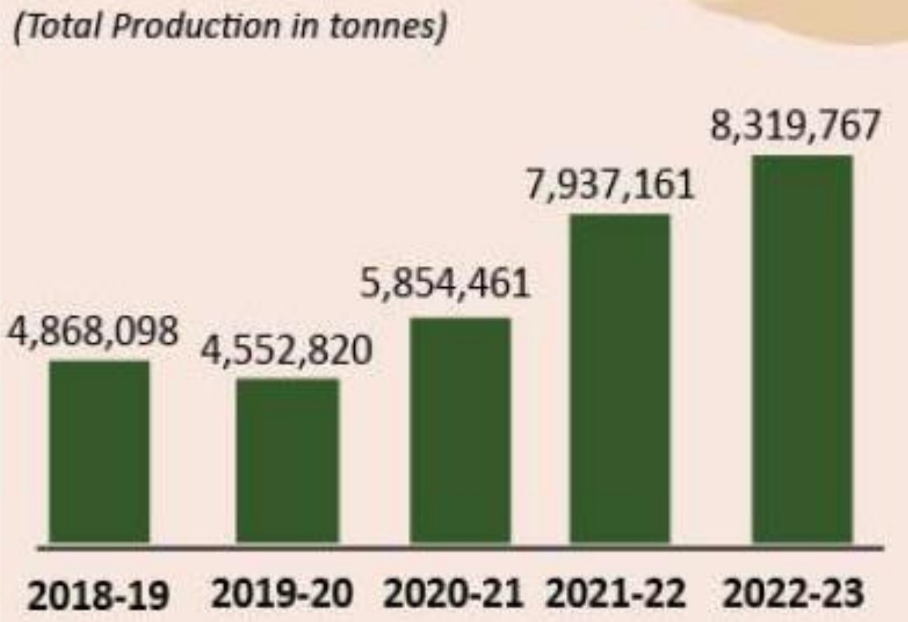
- Pakistan's agriculture sector contributes around 24 percent to the GDP and employs around 40 percent of the national labour force
- A Country of around 250 million people with 60% population below the age of 35.
- Largest irrigated land area in the World comes only after China, India and United States of America
- **Total cultivated land is 22.54 million hectares (44% of total area), while arable land is 31.22 million hectares (39% of total area)**
- **The agriculture sector in Pakistan witnessed robust growth in 2023-24, with an overall increase of 6.25 percent.**

PAKISTAN CAN BECOME ONE OF CHINA'S FAVORITE POTATO (AALU) EXPORTERS

- 4th most important crop after wheat, rice, and corn
- Self-sufficient in terms of internal consumption and seed production
- Annual per capita intake is over 15 kg-17 kg
- We have three crops of potatoes
- Autumn crop: October to February (70-75% market share)
- Spring crop: January to April (7-10% market share)
- Summer/hill crop: March to September (15-20% market share)

A total area of 0.341 million hectares in Pakistan was recorded to be utilized to farm potatoes in the year 2022-23.





Rank	Country	2022	2021	2020	2019	2018	2017	2016
1	China	95,570,055	94,300,000	92,800,000	89,500,000	90,259,155	88,481,500	84,928,500
2	India	56,176,000	54,230,000	48,562,000	50,190,000	51,310,000	48,605,000	43,417,000
3	Ukraine	20,899,210	21,356,320	20,837,990	20,269,190	22,503,970	22,208,220	21,750,290
4	Russia	18,887,679	18,295,535	19,607,361	22,074,874	22,394,960	21,707,645	22,463,487
5	United States	17,791,840	18,589,530	19,051,790	19,251,320	20,421,560	20,453,430	20,426,359
6	Germany	10,683,400	11,312,100	11,715,100	10,602,200	8,920,800	11,720,000	10,722,100
7	Bangladesh	10,144,835	9,887,242	9,606,000	9,655,082	9,744,412	10,215,957	9,474,099
8	France	8,067,380	8,987,220	8,822,180	8,560,410	7,860,380	8,547,354	6,954,983
9	Pakistan	7,936,884	5,872,960	4,552,656	4,869,312	4,591,776	3,852,897	3,977,595
10	Netherlands	6,915,900	6,675,590	7,020,060	6,961,230	6,025,370	7,391,881	6,534,338

Source: Ministry of National Food & Security 2022-23

POTATO CULTIVATION IN PAKISTAN. An Overview

Temperate, subtropical and tropical conditions

All soils except saline and alkaline soils

Ideal Soil with a pH range 5.2-6.4

Ridge sowing

R×R= 2 to 2.5 F

P×P=6-8 Inch

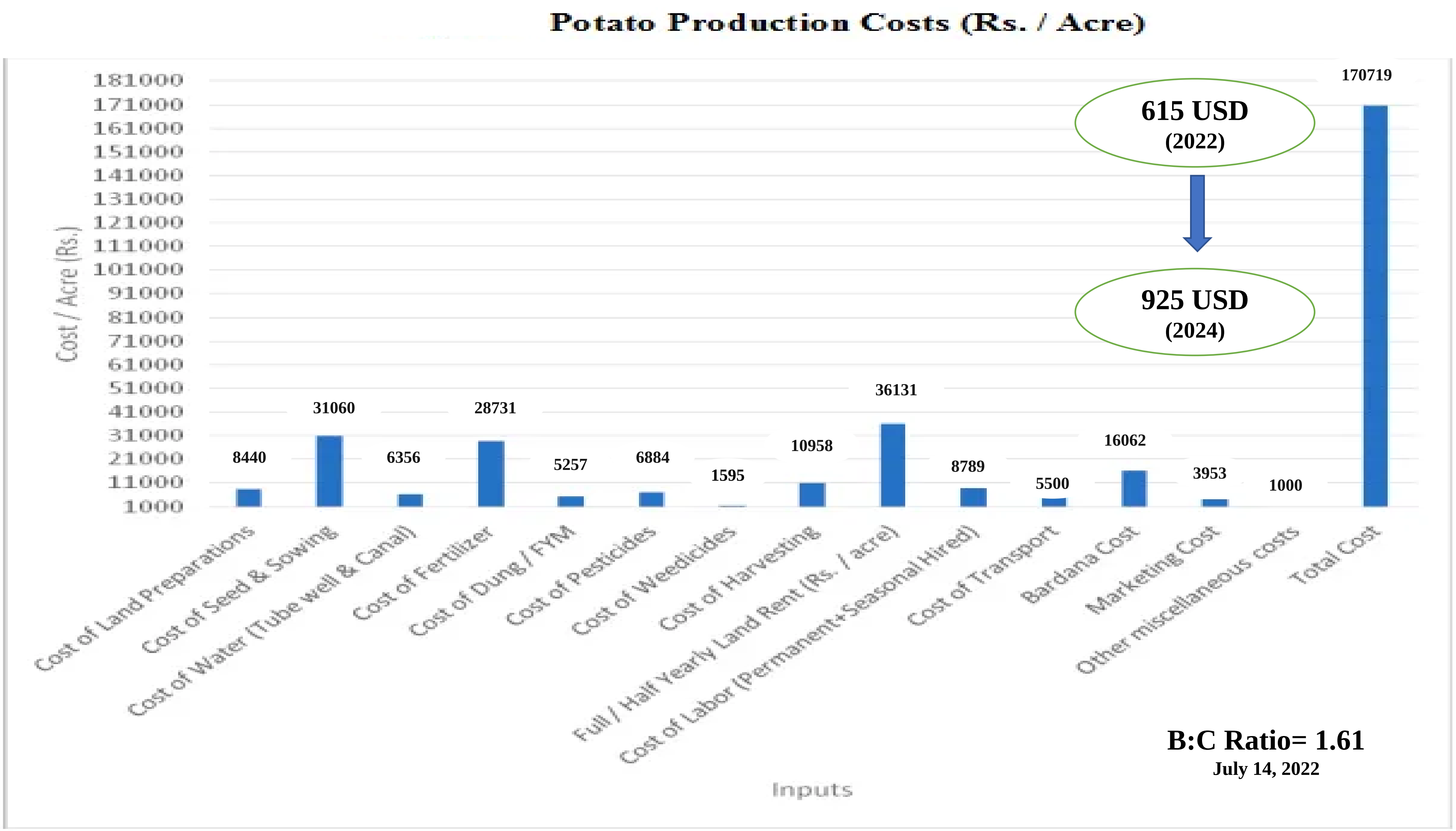
Seed rate: 1200-1500 Kg/acre

Arizona, Sante, Desiree, Cardinal, SH-5, Sadaf, Bartina, Esmee

Vegetative growth best at 20-25°C

Tuber formation best at16-24°C

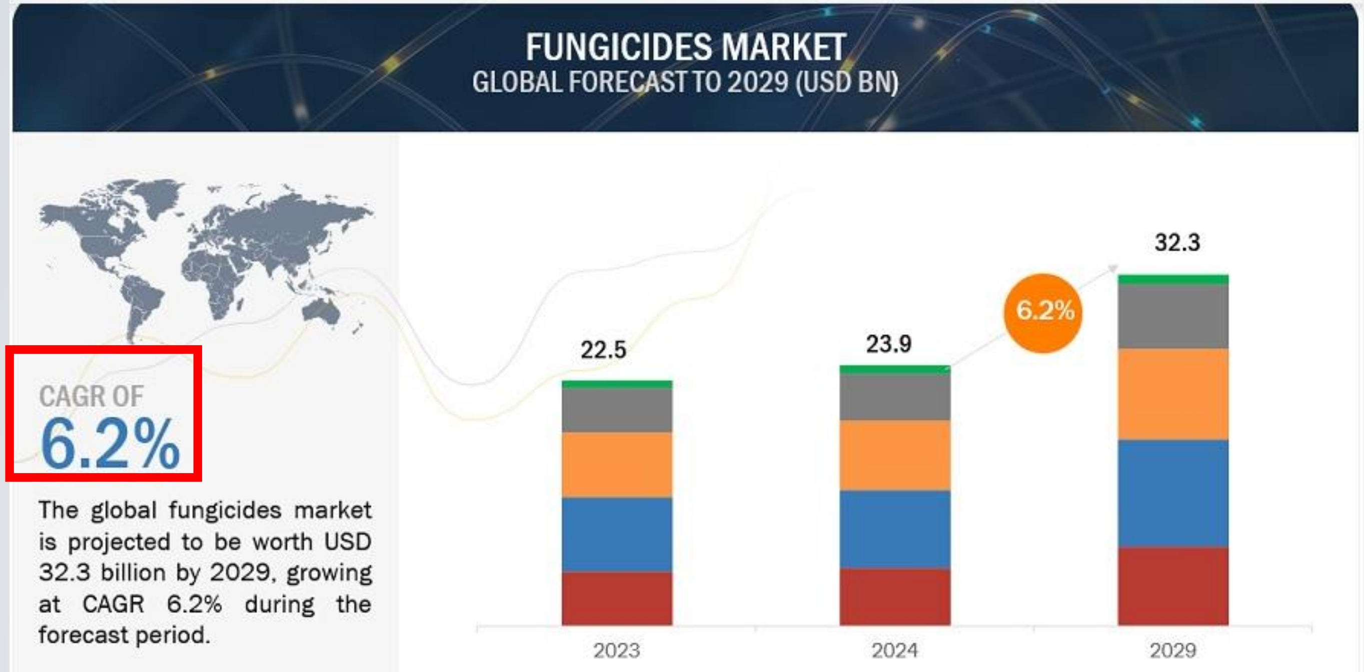
10-14 tones/acre


Potato Production Costs (Rs. / Acre)
Cost / Acre (Rs.)
181000
171000
161000
151000
141000
131000
121000
111000
101000
91000
81000
71000
61000
51000
41000
31000
21000
11000
1000
8440
31060
6356
28731
5257
6884
1595
10958
36131
8789
5500
16062
3953
1000
170719
615 USD
(2022)
925 USD
(2024)
Cost of Land Preparations
Cost of Seed & Sowing
Cost of Water (Tube well & Canal))
Cost of Fertilizer
Cost of Dung / FYM
Cost of Pesticides
Cost of Weedicides
Cost of Harvesting
Full / Half Yearly Land Rent (Rs. / acre)
Cost of Labor (Permanent+Seasonal Hired))
Cost of Transport
Bardana Cost
Marketing Cost
Other miscellaneous costs
Total Cost
Inputs
B:C Ratio= 1.61
July 14, 2022

Key fungicides for PLB in Pakistan

Fungicides	Active Ingredient	Company name	Dose/acre	Treatment cost/acre (US$	Company Market share	Producers (local or imported)
Revus Start Pepite 430 WG	Mandipropamid 250g/kg, Cymoxanil 180g/kg	Syngenta	200 gm	11.13 US$	20-25%	imported
Orandus Opti	400g/Lt Chlorothalonil + 6g/Lt Oxathiapiprolin	Syngenta	400 ml	10.59 US$	20-25%	imported
Dragon 40wp	270g/Kg Chlorothalonil 130g/Kg Pyrimenthanil WP	Syngenta	400 gm	11.49 US$	20-25%	imported
Antracol 70WP	Propineb 70% (Zinc Base)	Bayer	300-400 gm	11.54 US$	20-22%	imported
Cabriotop 60WDG	Pyraclostrobin 5% + Metiram 55%	FMC	600gm	14.18 US$	10-12%	imported
Acrobat Mz 90/600wp	Dimethomorph 90g Mancozeb 600g	FMC	250-300 gm	8.5 US$	10-12%	imported

Mordor Intelligence report



LARGEST SEGMENT BY APPLICATION MODE

60.18 %

Value Share, Foliar, 2023

Diseases such as Anthracnose, rust, blight, and powdery mildew, which affect the major food crops, can be effectively controlled using the fungicide application foliar method.

Pakistan Crop Protection Chemicals Market

Market Size in USD Million

CAGR 3.12%

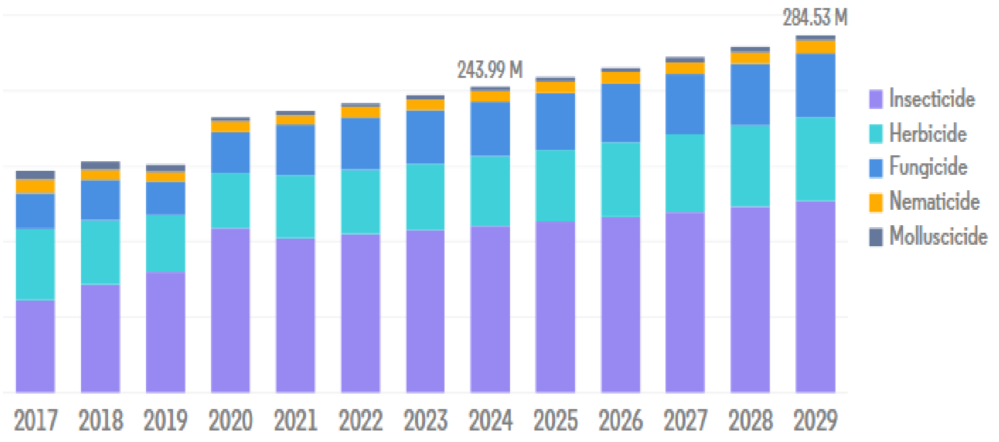
Source : Mordor Intelligence

Study Period	2017 - 2029
Market Size (2024)	USD 243.99 Million
Market Size (2029)	USD 284.53 Million
Largest Share by Function	Insecticide
CAGR (2024 - 2029)	3.12 %
Fastest Growing by Function	Herbicide

Major Players

*Disclaimer: Major Players sorted in alphabetical order.

Crop Protection Chemicals Market by function, USD, Pakistan, 2017 - 2029



Source: Mordor Intelligence

SWOT Analysis

Strengths

- Vital role in crop protection and yields
- Stable Demand
- Healthy margins
- Low import duties

Punjab produces 97.8% of potatoes 2022-23

Weaknesses

- Unorganized sector lacking corporate culture
- High Competition
- Complete dependence on imported chemical compounds
- Exposure to exchange rate movement
- No investment in research and development

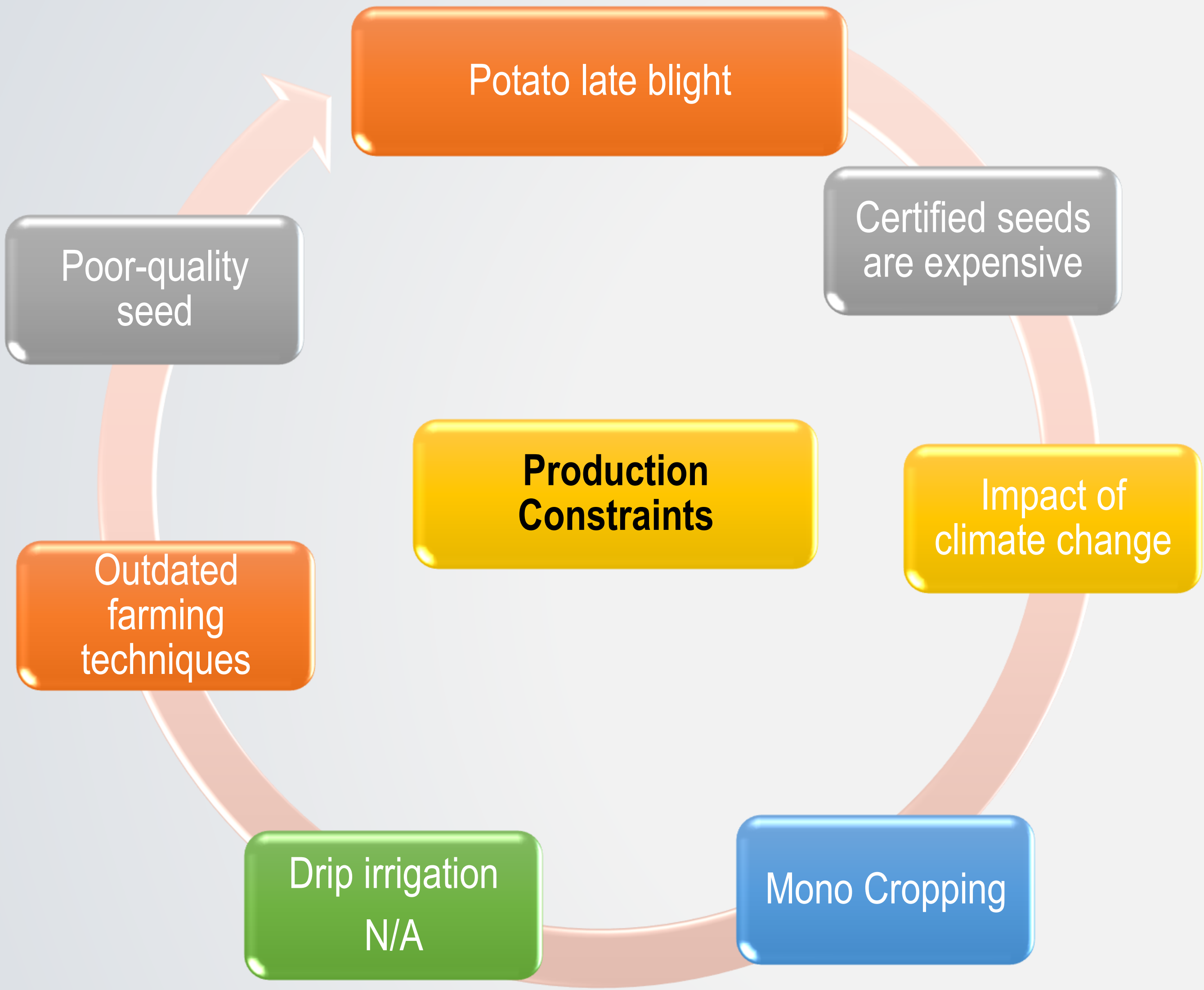
Threats

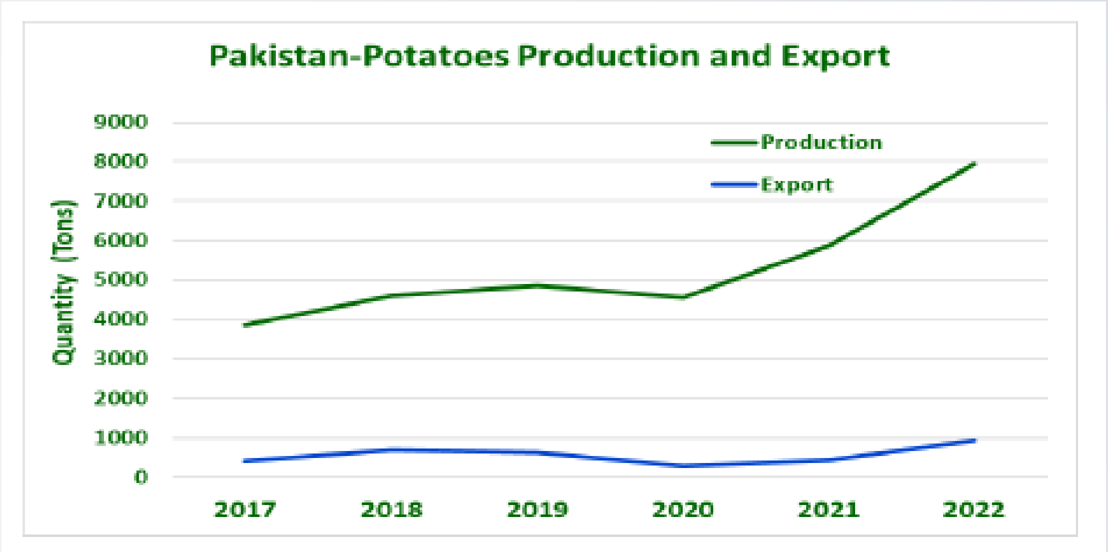
- Supply chain disruptions
- Reduced crop production
- Reduction in area under cultivation
- Low barrier to entry
- Rising health concern due to excessive use of pesticides

165.3 grams per hectare in 2022

Opportunities

- Foster investment in research and development through supportive legislation.
- Increase efficiency and improve quality through technological upgrade
- Low interest rates
- Introduction of biopesticides





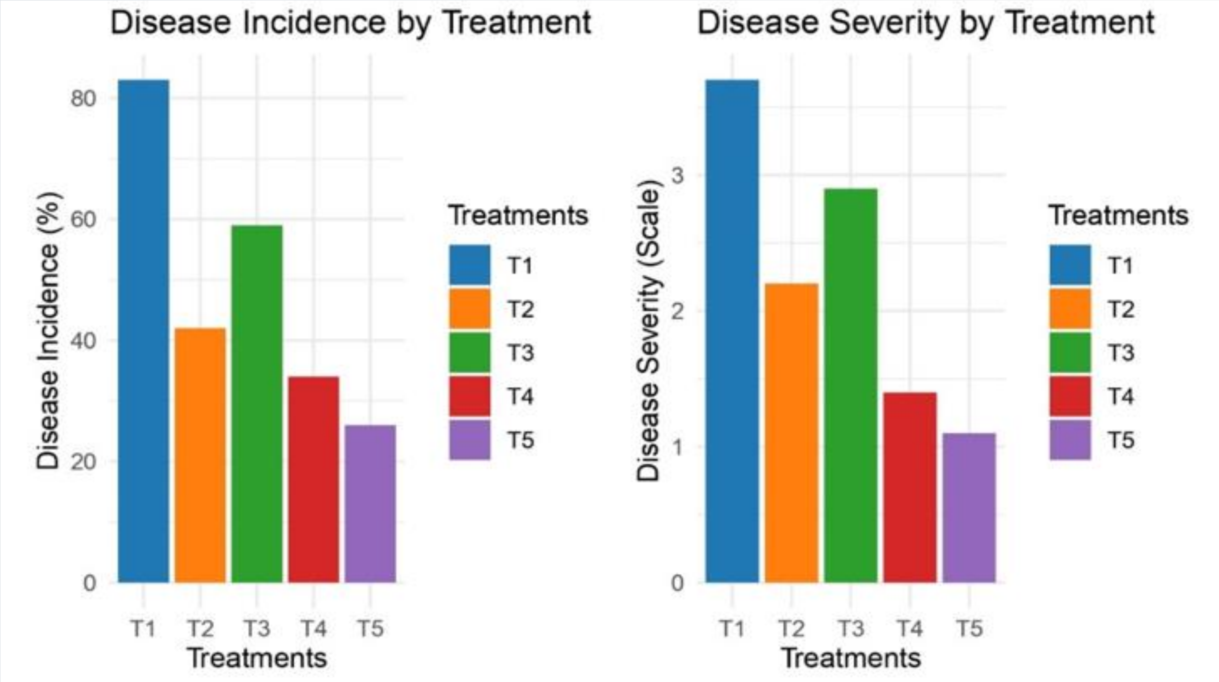
Reporter	Exports 2023	
	Value (US$)	World Share ($)
Netherlands	1,218,089,854.52	20.16
France	1,072,221,713.57	17.75
Germany	659,035,572.40	10.91
Canada	469,185,368.25	7.76
Egypt	396,703,393.16	6.56
USA	339,437,004.00	5.61
Belgium	249,601,192.61	4.13
China	229,678,633.00	3.80
Spain	217,316,044.97	3.59
United Kingdom	184,405,787.83	3.05
Pakistan	140,191,089.01	2.32
India	103,087,012.49	1.70
Israel	88,560,000.00	1.46
Denmark	74,863,277.65	1.23
Italy	71,213,400.14	1.17

LATE BLIGHT (PLB) IN PAKISTAN

- ❖**PLB was first reported in 1984 in Swat, KPK by** Khan et al., 1985
- ❖**The A2 mating type of *P. infestans* was first distinguished by** Ahmad & Mirza (1995)
- ❖**Genotyping of samples collected in 2019-20 has identified the presence of genotype 13_A2** (Raza et al., 2020)
- ❖**50-70% losses in Pakistan with potential yield losses upto 100% under epidemic conditions** (Ahmad et al., 2015)

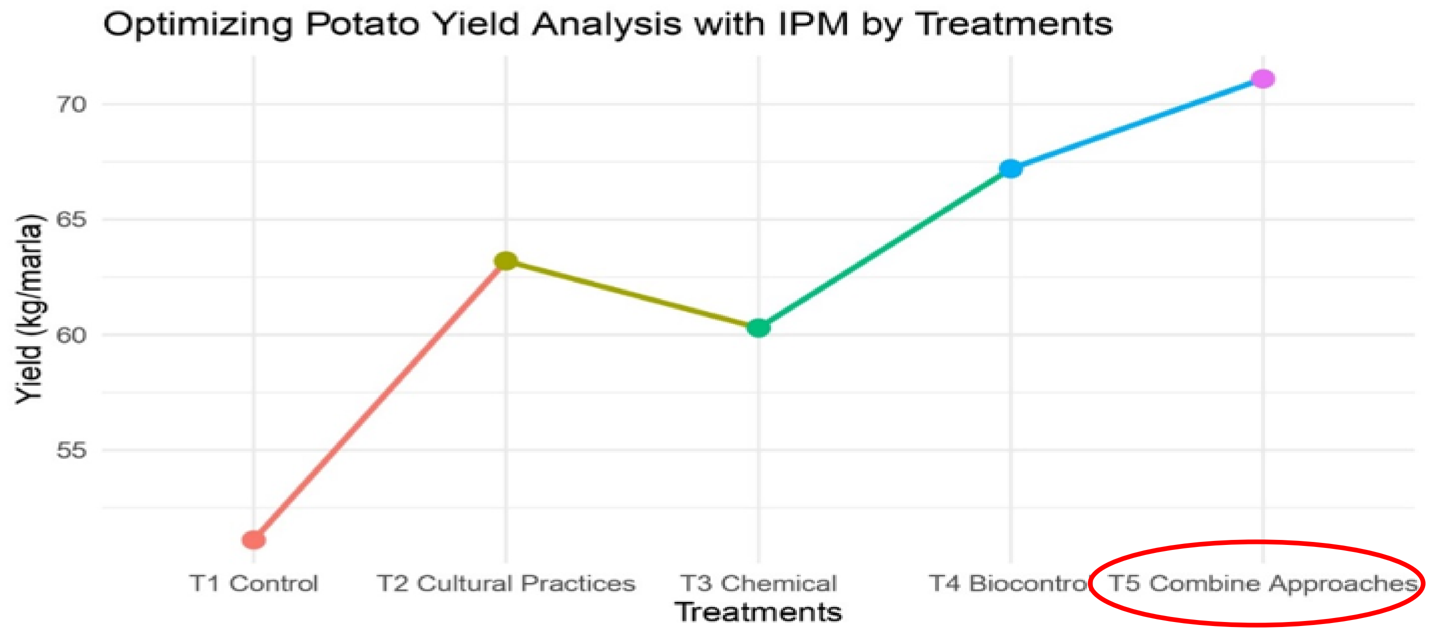
Representative work related to PLB (Pak.)

- **Raza, W.**, Ghazanfar, M. U., Sullivan, L., Cooke, D. E., & Cooke, L. R. (2021). Mating type and aggressiveness of *Phytophthora infestans* (Mont.) de Bary in potato-growing areas of Punjab, Pakistan, 2017–2018 and identification of genotype 13_A2 in 2019–2020. Potato Research, 64, 115-129.
- Razzaq, H. A., Ijaz, S., Haq, I. U., & Khan, I. A. (2022). Functional inhibition of the StERF3 gene by dual targeting through CRISPR/Cas9 enhances resistance to the late blight disease in *Solanum tuberosum* L. Molecular Biology Reports, 49(12), 11675-11684.
- Majeed, A., Muhammad, Z., Ullah, Z., Ullah, R., & Ahmad, H. (2017). Late blight of potato (*Phytophthora infestans*) I: Fungicides application and associated challenges. Turkish Journal of Agriculture-Food Science and Technology, 5(3), 261-266.
- Majeed, A., Muhammad, Z., Ahmad, H., Islam, S., Ullah, Z., & Ullah, R. (2017). Late blight of potato (*Phytophthora infestans*) II: Employing integrated approaches in late blight disease management. PSM Biological Research, 2(3), 117-123.
- Rajputt, N. A., Khan, S. A., & Ahmad, A. (2017). Population structure of *Phytophthora infestans* on worldwide scale: a review. Pakistan Journal of Phytopathology, 29(2), 281-288.
- Nadeem Ahmed, N. A., Khan, M. A., Khan, N. A., & Ali, M. A. (2015). Prediction of potato late blight disease based upon environmental factors in Faisalabad, Pakistan.
- Chaudhry, A. M. Z., & Muhammad, Z. (2014). Variation in the aggressiveness of *Phytophthora infestans* pathotypes collected from different potato fields of Khyber Pakhtunkhwa (Pakistan). International Journal of Agriculture and Biology, 16(4).
- Rashid, A., Ahmad, I., Iram, S., Mirza, J. I., & Rauf, C. A. (2004). Efficiency of different neem (*Azadirachta indica* A. Juss) products against various life stages of *Phytophthora infestans* (Mont.) Debary. Pak. J. Bot, 36(4), 881-886.
- Khan, M. A., Rashid, A., Ullah, O. B. A. I. D., & Iqbal, M. J. (2003). Control of late blight of potato by foliar application of fungicides. Int. J. Agric. Biol, 5(4), 540-542.



Enhancing Potato crop yield through innovative treatment approaches with chemical and biological agents

Treatment	Chemical/Biological Agent	Yield (tones/acre)
Control (No Treatment)	None	8.176
Cultural Practices	Crop Rotation (Sesame)	10.112
Biological Agents	*Trichoderma harzianum* + Bacillus spp (Biocontrol)	9.648
Chemical Pesticides	Fungazil (Fungicide)	10.752
Combined Approach (Bio+ Chem)	Fungazil + *Trichoderma harzianum*	11.376



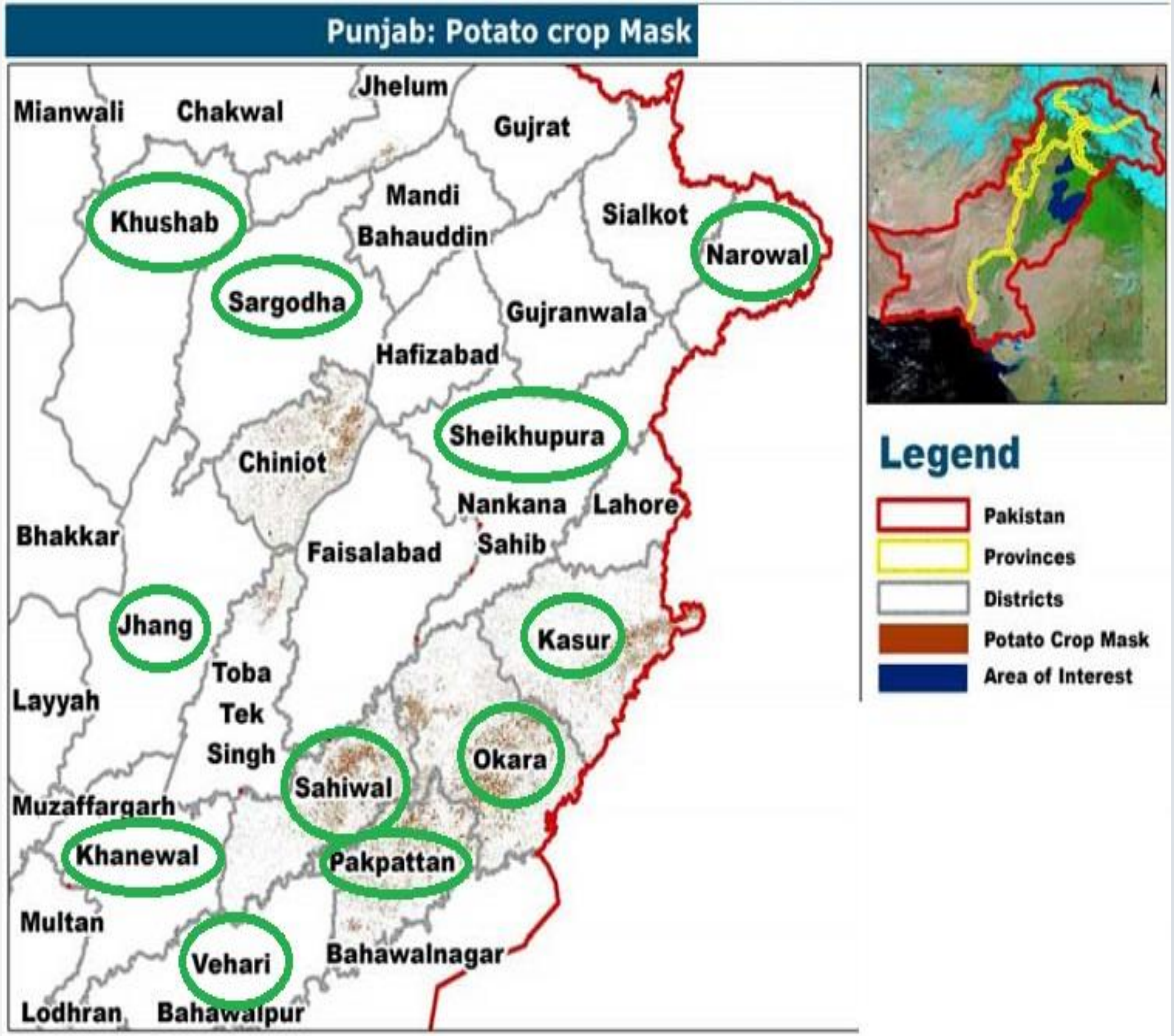
IPM's impact on disease Control and yield

Integrated pest management strategies for controlling PLB and enhancing crop yield

(Nauman et al., 2024)

Prevalence of Late Blight

Up to 40% (Okara District)



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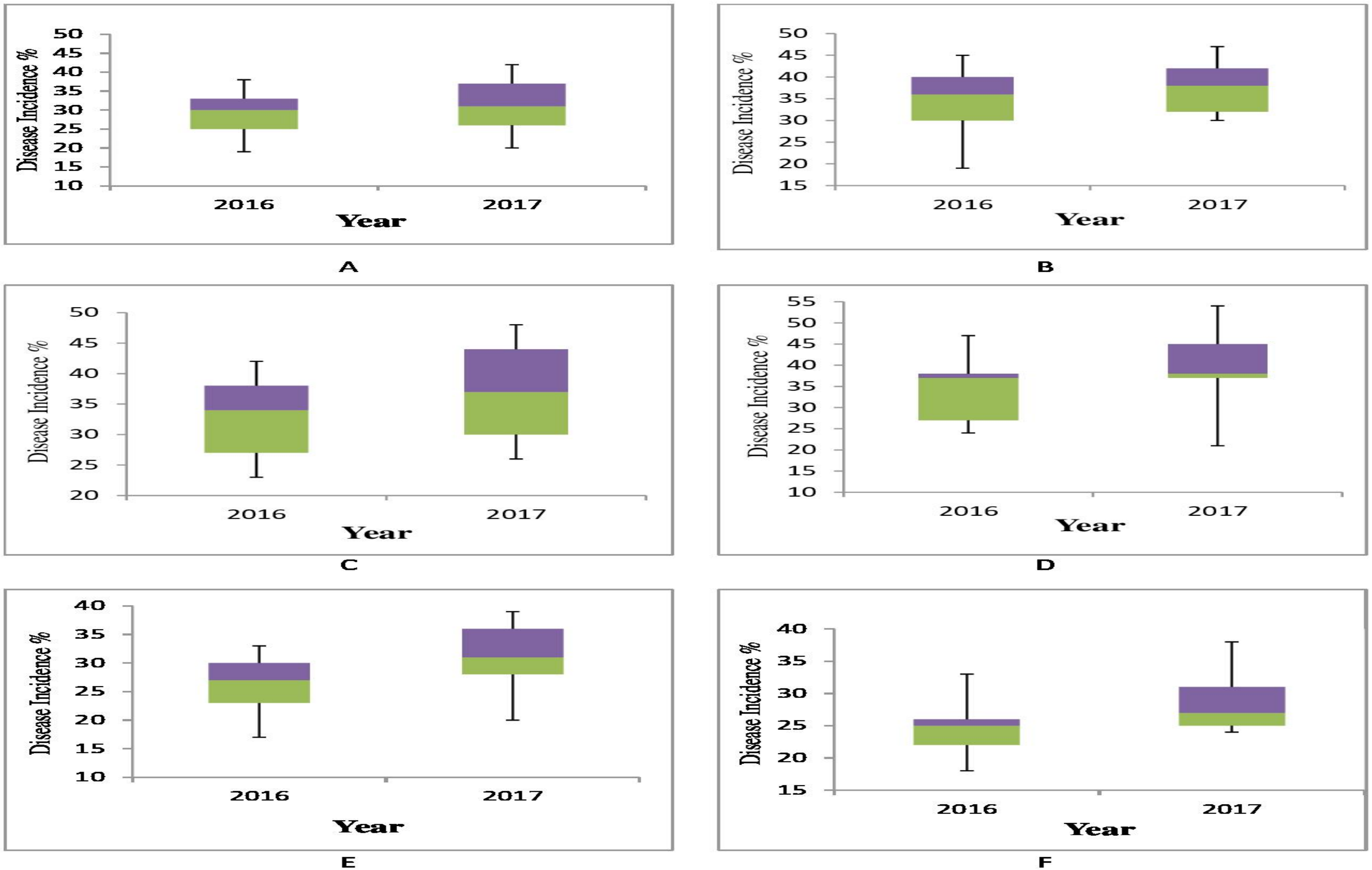
Results: Disease Incidence from different locations



Box plots showing disease Incidence of different districts showing increase in incidence 2016 &17 (A) Khushab (B) Sargodha (C) Sahiwal (D) Okara (E) Chiniot (F) Jhang

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Quick Overview

Aggressiveness Tests

$$CAI = \frac{\text{Infection frequency x Lesion area}}{\text{Latent infection period}}$$

- Infection frequency calculations were recorded as described by Carlisle et al. (2002)
- *Isolates with CAI ≥ 1000 were considered as highly aggressive, CAI were ≥ 500 and < 1000 as moderately aggressive and CAI < 500 as weakly aggressive.*

(Carlisle et al., 2002; Chacon et al., 2007; Montarry et al., 2007; Majeed et al., 2014)

Fitness Tests

$$CFI = \frac{\text{lesion area x sporulation capacity}}{\text{Latent period}}$$

*Sporulation capacity was expressed as zoospores produced of leaf disc area

Isolates with CFI ≥ 1000 were considered as highly fit and considered for further experiments.

(Knapova and Gisi, 2002)

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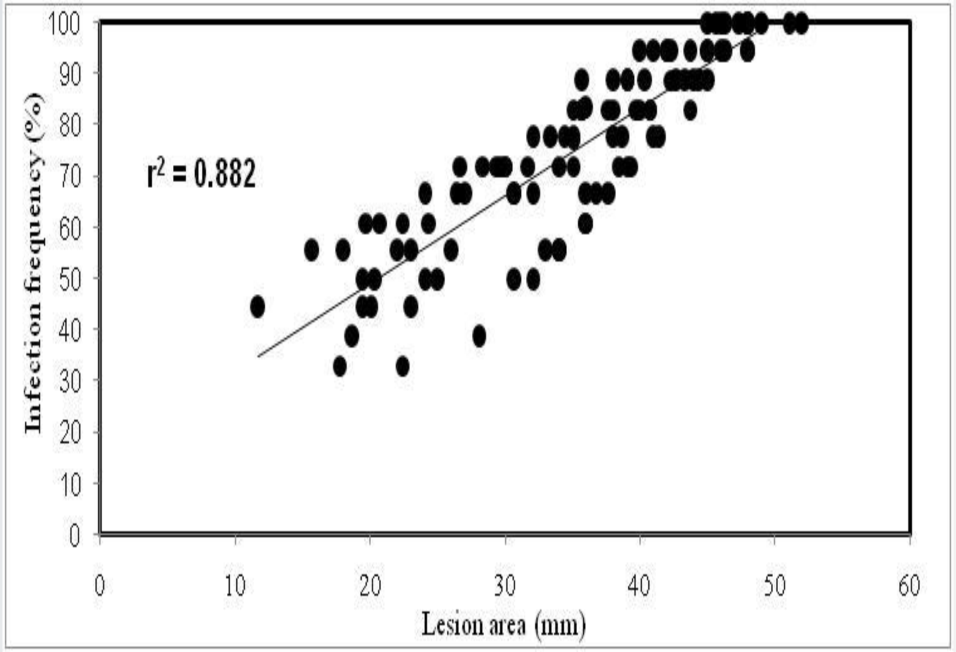
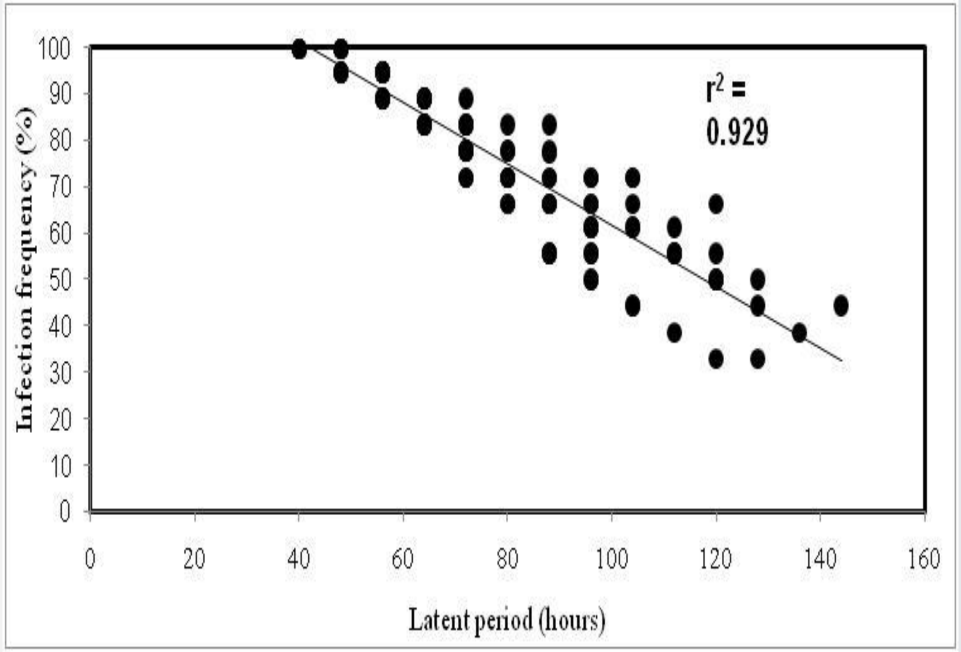
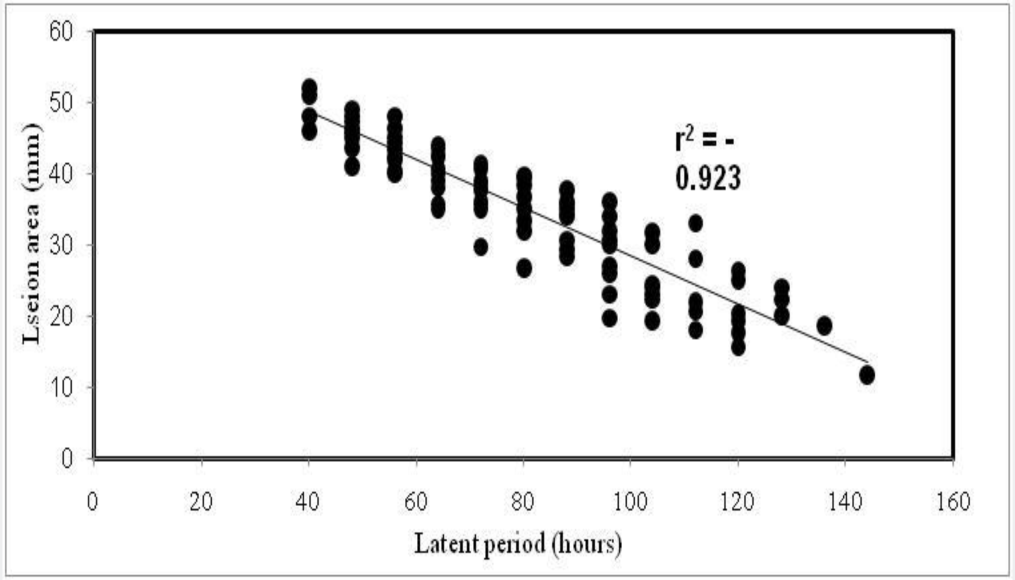
CAI (Composite Aggressiveness Index)
CFI (Composite Fitness Index)

Results







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The three parameters of aggressiveness (LA, LIP and IF) were very highly significant (P<0.001) correlated with each other and with the CAI; the CAI was therefore used for subsequent comparisons.

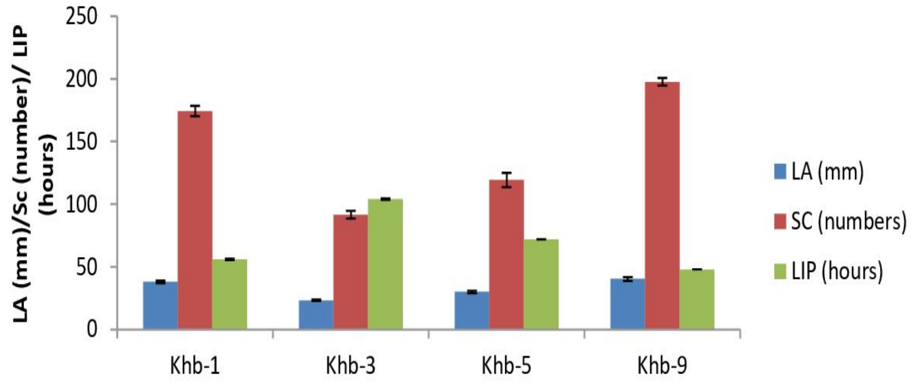


Fig 1: Isolates collected from Kkushab-2017

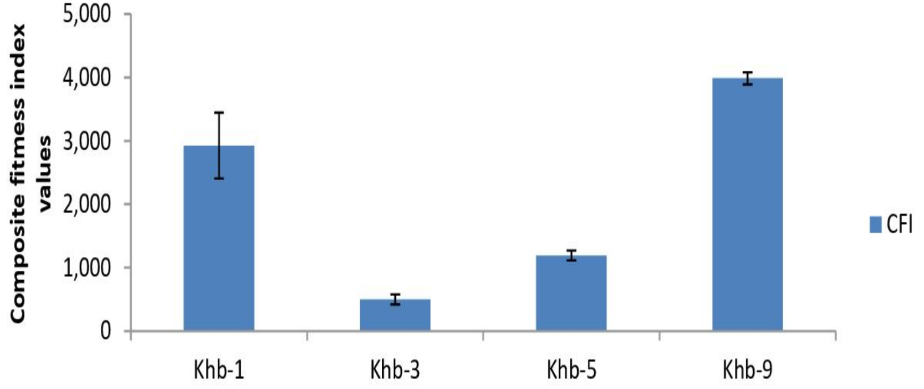
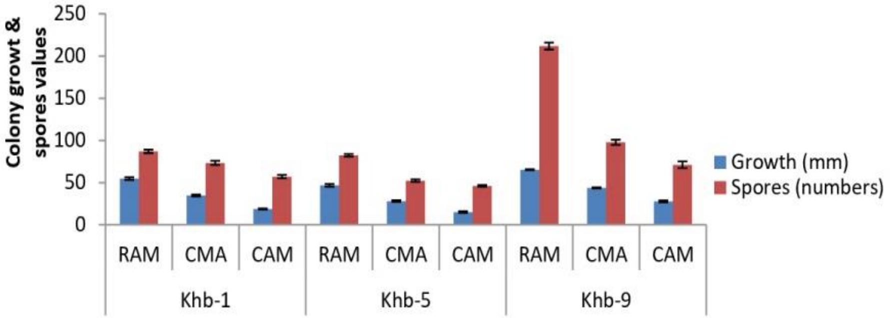
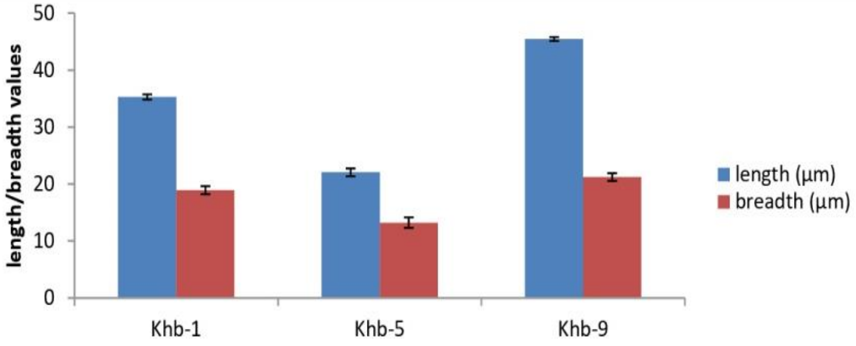


Fig 2: Composite fitness index of Khushab isolates-2017

Results for Pathogen Fitness



A: Isolates collected from Khushab-2017



A: Isolates collected from Khushab-2017

Evaluation of Different Media for Selected Isolates

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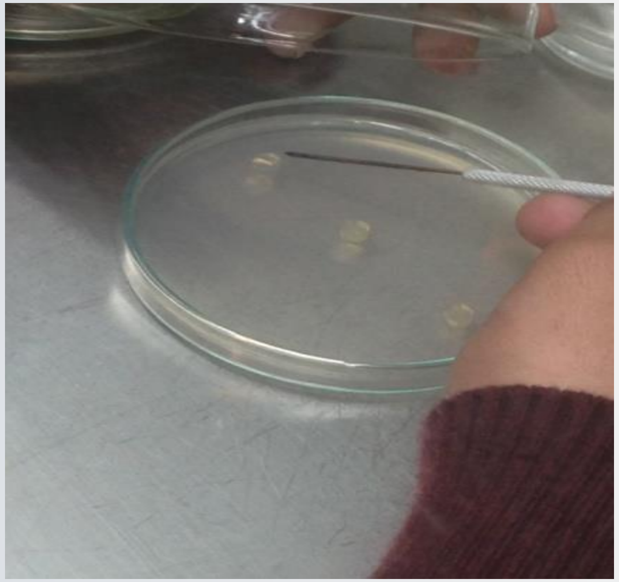
Mating type of *Ph. infestans* isolates potato growing areas of Punjab, Pakistan



Mating type test

Year and Area	Total number of isolates	Number of isolates of mating type		
		A1	A2	Self fertile
2017				
Khushab	10	9	1	0
Sargodha	12	10	2	0
Sahiwal	13	8	4	1
Okara	14	7	6	1
Jhang	12	12	0	0
Chiniot	11	9	2	0
Total	72	55 (76)[a]	15 (21)[a]	2 (3)[a]
2018				
Khushab	12	12	0	0
Sargodha	13	10	2	1
Sahiwal	13	7	5	1
Okara	15	6	8	1
Jhang	12	10	2	0
Chiniot	12	9	2	1
Total	77	54 (70)	19 (25)	4 (5)
Total 2017-2018	149	109 (73)[a]	34 (23)[a]	6 (4)[a]

a shows Percentage of isolates of each mating type

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Research Conclusion

Our work can contribute to the knowledge of this pathogen spread and promote future studies to understand its evolution, diversity and improve management decisions in the control of PLB.

Mating types (A1 and A2) are distributed throughout surveyed areas while A1 is more abundant in PAK.

The aggressive and most fit isolates belong to A2 in PAK. which highlight and emphasize the importance of population genetic study.

Based upon the above fact, application of fungicides should be according to prevalence, aggressiveness and mating types present in the field.

RESEARCH OBJECTIVES AT NAU

Investigate **un-explored fungicide combinations**, leveraging diverse modes of action, to discover potential control strategy

To determine the **minimum effective concentrations** of fungicide combinations against *P. infestans* to minimize environmental and human health hazards

南京農業大學
NANJING AGRICULTURAL UNIVERSITY

Idea of Propose Work 工作提案构想

Step-1

Develop Novel fungicide (in combination) formulations

Step-2

Screening of field collected isolates against fungicides in order to get natural resistant isolates

Step-3

To identify and validate the role of the resistance genes

Step-4

AMT Study: to introduce the DNA containing the resistant gene (gene of interest) into the sensitive strain

Step-5

Evaluate the efficacy of the best formulated fungicide combinations (step 1) against genetically resistant mutants

01

Oxathiapiprolin (Systemic fungicide)

Oxysterol-binding protein

Linked with lipid transport and signaling pathways

Main targeted fungicide

02

Cyazofamid (Protectant fungicides)

Cytochrome bc1 complex

ATP production and energy metabolism

03

Pyraclostrobin (Protectant fungicides)

Cytochrome bc1 complex

04

Cymoxanil (Translaminar fungicides)

Unknown ?

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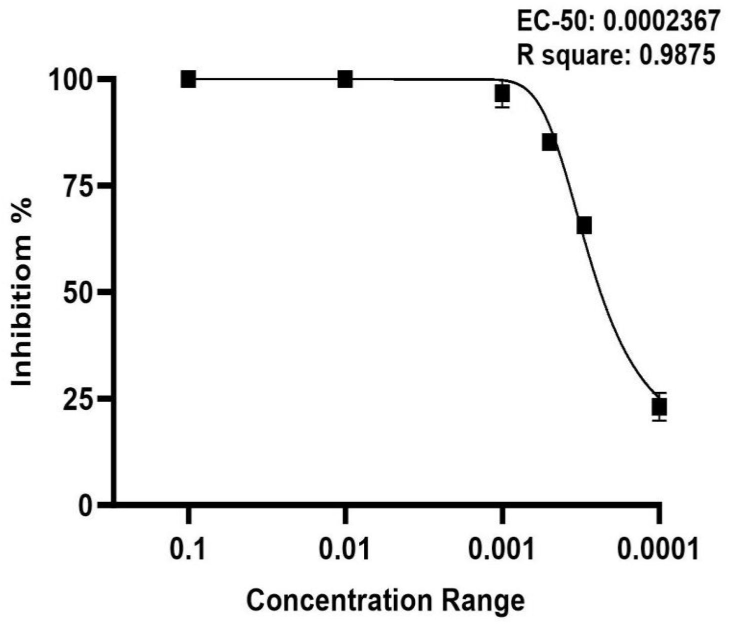
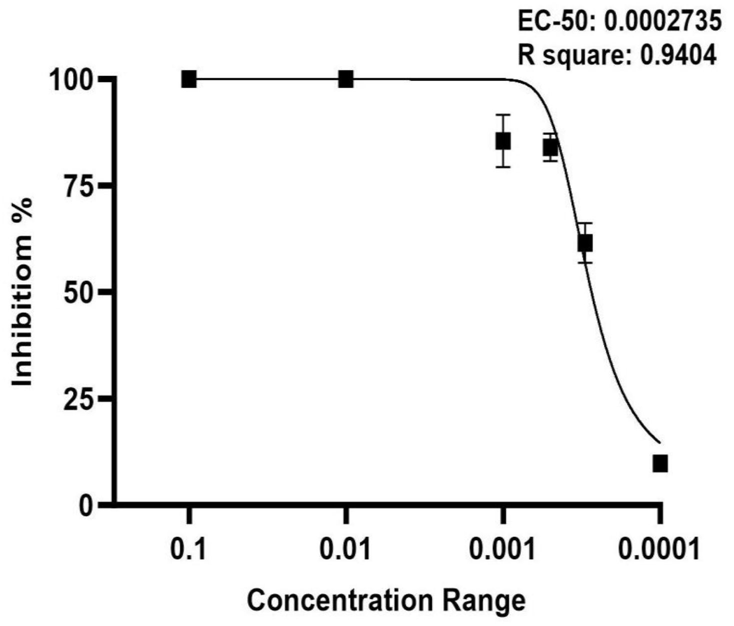
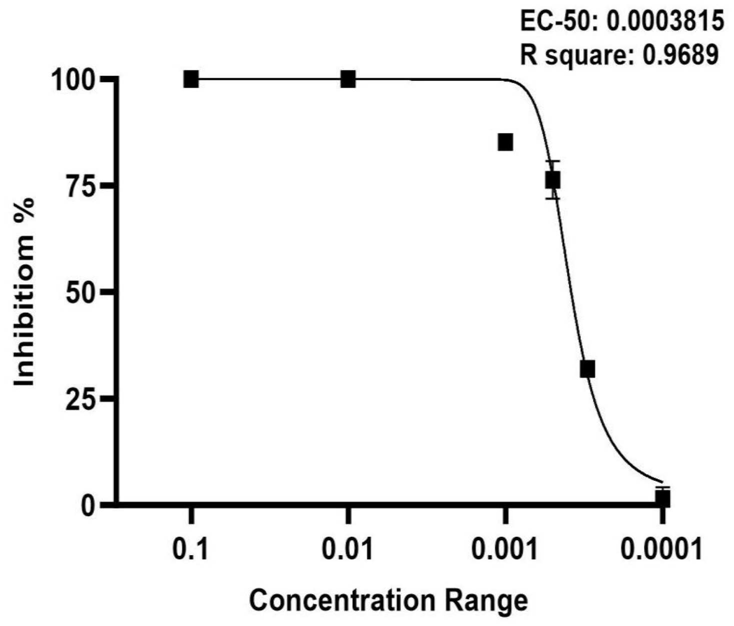


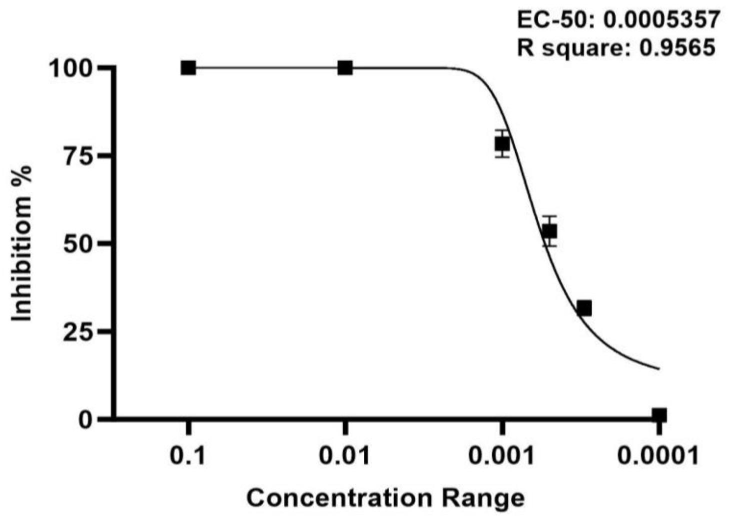
Oxathiapiprolin + Cymoxanil (4:1)



Oxathiapiprolin + Cymoxanil (3:2)



Oxathiapiprolin + Cymoxanil (2:3)



Oxathiapiprolin + Cymoxanil (1:4)

Graphical representation of fungicides (Oxathiapiprolin + Cymoxanil) response having different combinations

*The EC values and concentrations are in µg/ml unit

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The all tested combinations showed synergistic effect

- CCCAP's plans to implement a self-sustaining Asia-Blight network

AsiaBlight

Potato late blight network for Asia

Main Aim of Asia-Blight Network

- The first objective when Asia-Blight was created in 2015 was to establish a coarse scale map of *Phytophthora infestans* in the region.

Sample collection via FTA card for Pop. analysis

Sampling

Placed and Rub on FTA card

Air drying, ready for extraction of DNA

AsiaBlight
Potato late blight network for Asia

FTA card sampling.
https://www.youtube.com/watch?v=BQLe0G7vdHY 9
https://www.youtube.com/watch?v=BQLe0G7vdHY

Progress to date…

Sr#	Name of Country	No. FTA Cards	Collection Year	No. Sample	Status in Yes/No.
1	Pakistan	6, 28	2019 & 2023	24, 56	Processed
2	India	-	-	-	Within India
3	Uzbekistan	6	2022	24	Processed
4	Tajikistan	5	2022	10	Processed
5	Vietnam	2, 1	2020, 2022	08, 04	Processed
6	Philippine	35	2022	102	Processed
7	China	130	2019-2022	396	Processed
8	Korea	18	2023	36	Processed
9	Nepal	28	2023	28	Processed
10	Kyrgyzstan	5	2023	10	Processed
11	Georgia	4	2018	8	Processed

Thanks to **David Cooke and his staff,** we now have samples genotyped

Samples processed
700 plus
DNA + PCR+ Results

AsiaBlight
Potato late blight network for Asia

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Results of Processed samples

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基因型情况-2022年结果 (China)

Hebei

EU_13_A2

2019, 2021

Heilongjiang

SIB-1_A1, EU_13_A2, US-11

2020

Shaanxi

SIB-1_A1

2020

Yunnan

EU_13_A2

2019

Gansu

EU_13_A2

2020

Chongqing

SIB-1_A1, EU_13_A2

2019

Ningxia Hui Region

EU_13_A2

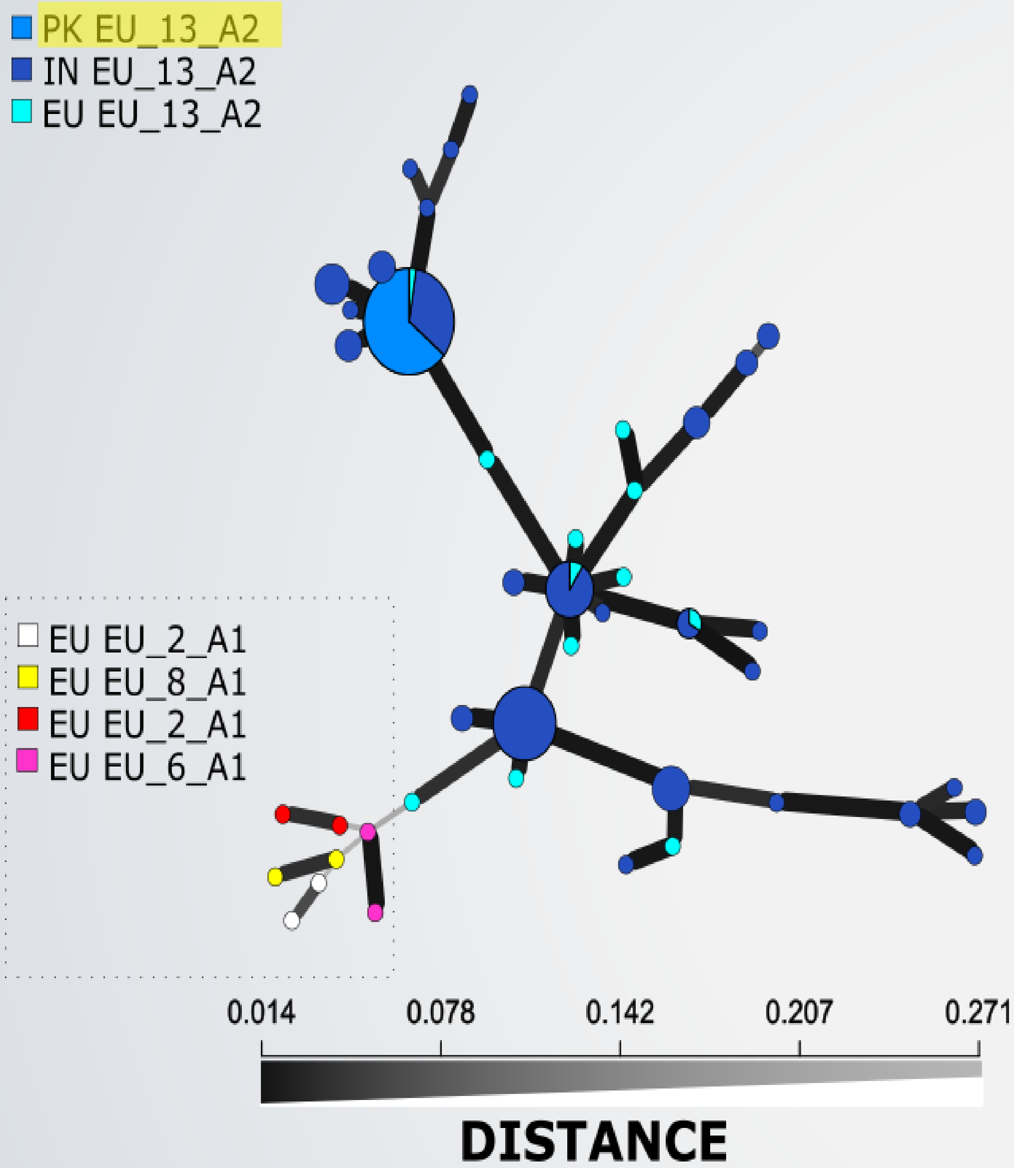
2020

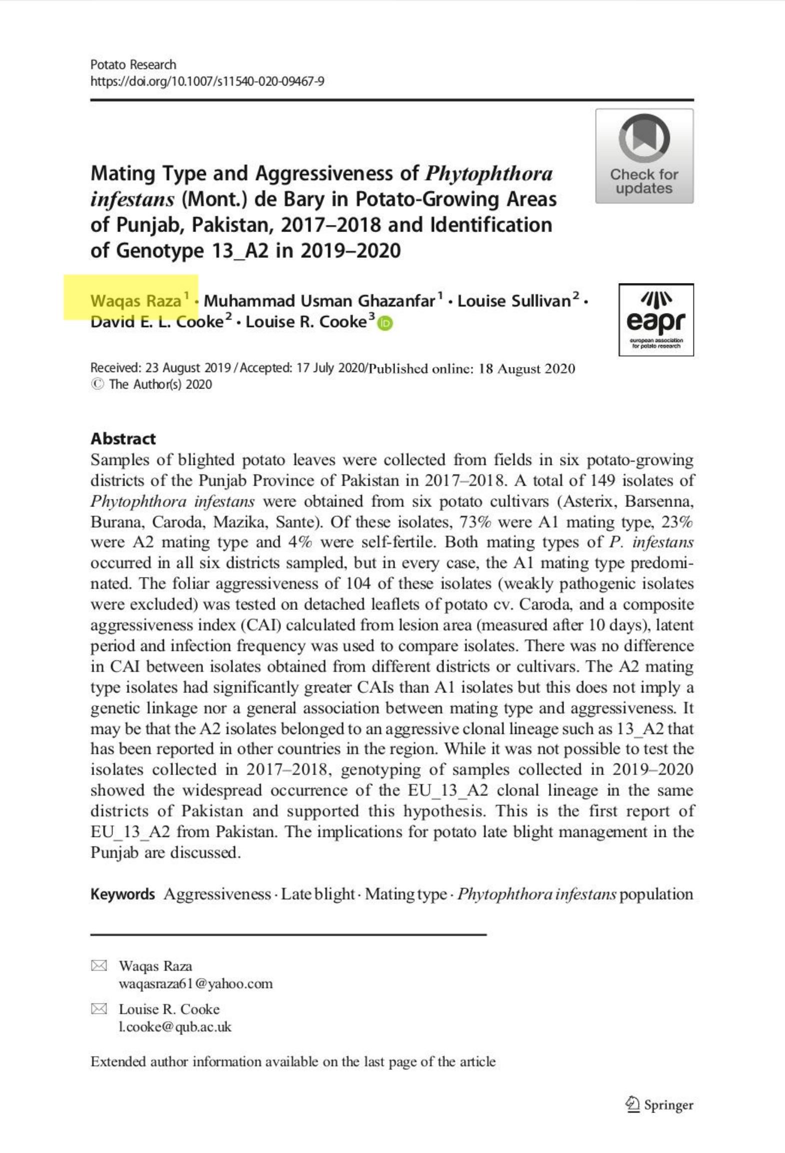
Sichuan

EU_13_A2, SIB-1_A1

2019, 2020, 2021

AsiaBlight
Potato late blight network for Asia




Potato Research
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Check for updates

Mating Type and Aggressiveness of *Phytophthora infestans* (Mont.) de Bary in Potato-Growing Areas of Punjab, Pakistan, 2017–2018 and Identification of Genotype 13_A2 in 2019–2020

Waqas Raza[1] · Muhammad Usman Ghazanfar[1] · Louise Sullivan[2] · David E. L. Cooke[2] · Louise R. Cooke[3]

eapr european association for potato research

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Abstract
Samples of blighted potato leaves were collected from fields in six potato-growing districts of the Punjab Province of Pakistan in 2017–2018. A total of 149 isolates of *Phytophthora infestans* were obtained from six potato cultivars (Asterix, Barsenna, Burana, Caroda, Mazika, Sante). Of these isolates, 73% were A1 mating type, 23% were A2 mating type and 4% were self-fertile. Both mating types of *P. infestans* occurred in all six districts sampled, but in every case, the A1 mating type predominated. The foliar aggressiveness of 104 of these isolates (weakly pathogenic isolates were excluded) was tested on detached leaflets of potato cv. Caroda, and a composite aggressiveness index (CAI) calculated from lesion area (measured after 10 days), latent period and infection frequency was used to compare isolates. There was no difference in CAI between isolates obtained from different districts or cultivars. The A2 mating type isolates had significantly greater CAIs than A1 isolates but this does not imply a genetic linkage nor a general association between mating type and aggressiveness. It may be that the A2 isolates belonged to an aggressive clonal lineage such as 13_A2 that has been reported in other countries in the region. While it was not possible to test the isolates collected in 2017–2018, genotyping of samples collected in 2019–2020 showed the widespread occurrence of the EU_13_A2 clonal lineage in the same districts of Pakistan and supported this hypothesis. This is the first report of EU_13_A2 from Pakistan. The implications for potato late blight management in the Punjab are discussed.

Keywords Aggressiveness · Late blight · Mating type · *Phytophthora infestans* population

Waqas Raza
waqasraza61@yahoo.com

Louise R. Cooke
l.cooke@qub.ac.uk

Extended author information available on the last page of the article

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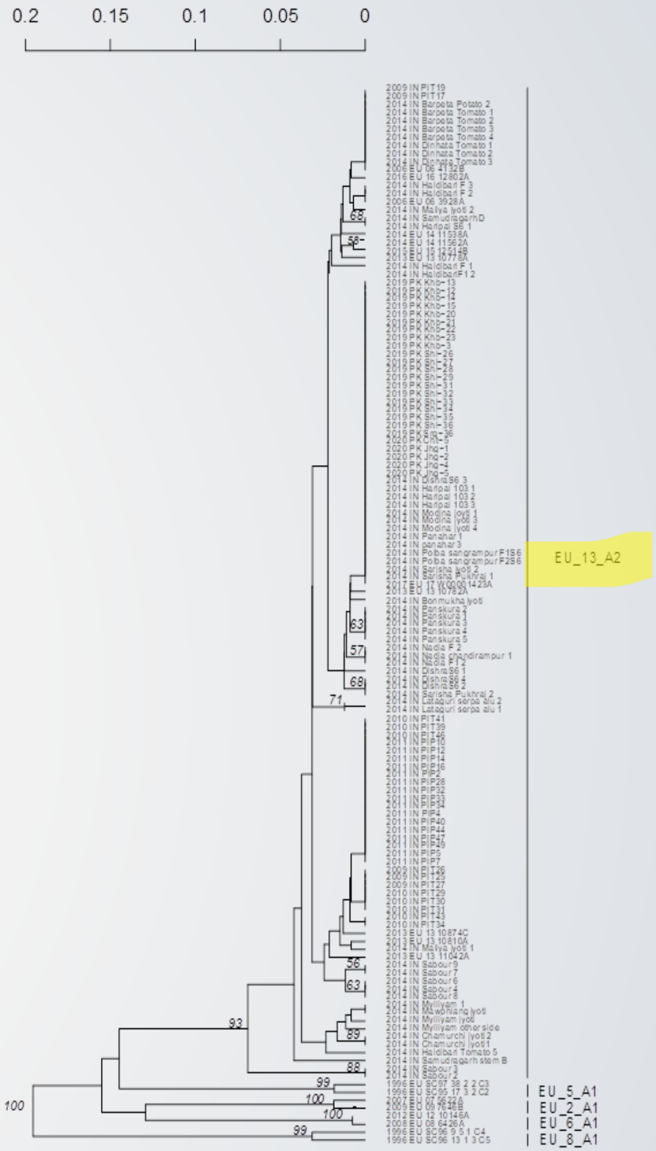


MSN showed that the single type of SSR profile seen in PK also matched that seen in IN. This type has also been sampled in Europe. Due to this wide distribution, it might be possible to speculate on the route this clone may have taken into PK via EU & IN.

Raza, UOS

Important points observed

- Genotype 22_A2 (PH.) – these are the former A2 lineages in Europe (1990s) and interesting to see in Asia.
- Genotype Blue13_A2 not appear some samples in PK which is interesting
- Genotype 37_A2 (Tajkistan) – fluazinam resistant found
- KR_1 is unique to South Korea, susceptible to metalaxyl ; it may be due to the SIB-1 genotype, and SIB-1 is also resistant to metalaxyl.

Plant Pathology An International Journal edited by the British Society for Plant Pathology

ORIGINAL ARTICLE | Open Access

The EU43 genotype of *Phytophthora infestans* displays resistance to mandipropamid

Isaac K. Abuley, James S. Lynott, Jens G. Hansen, David E. L. Cooke, Alison K. Lees

First published: 28 April 2023 | https://doi.org/10.1111/ppa.13737

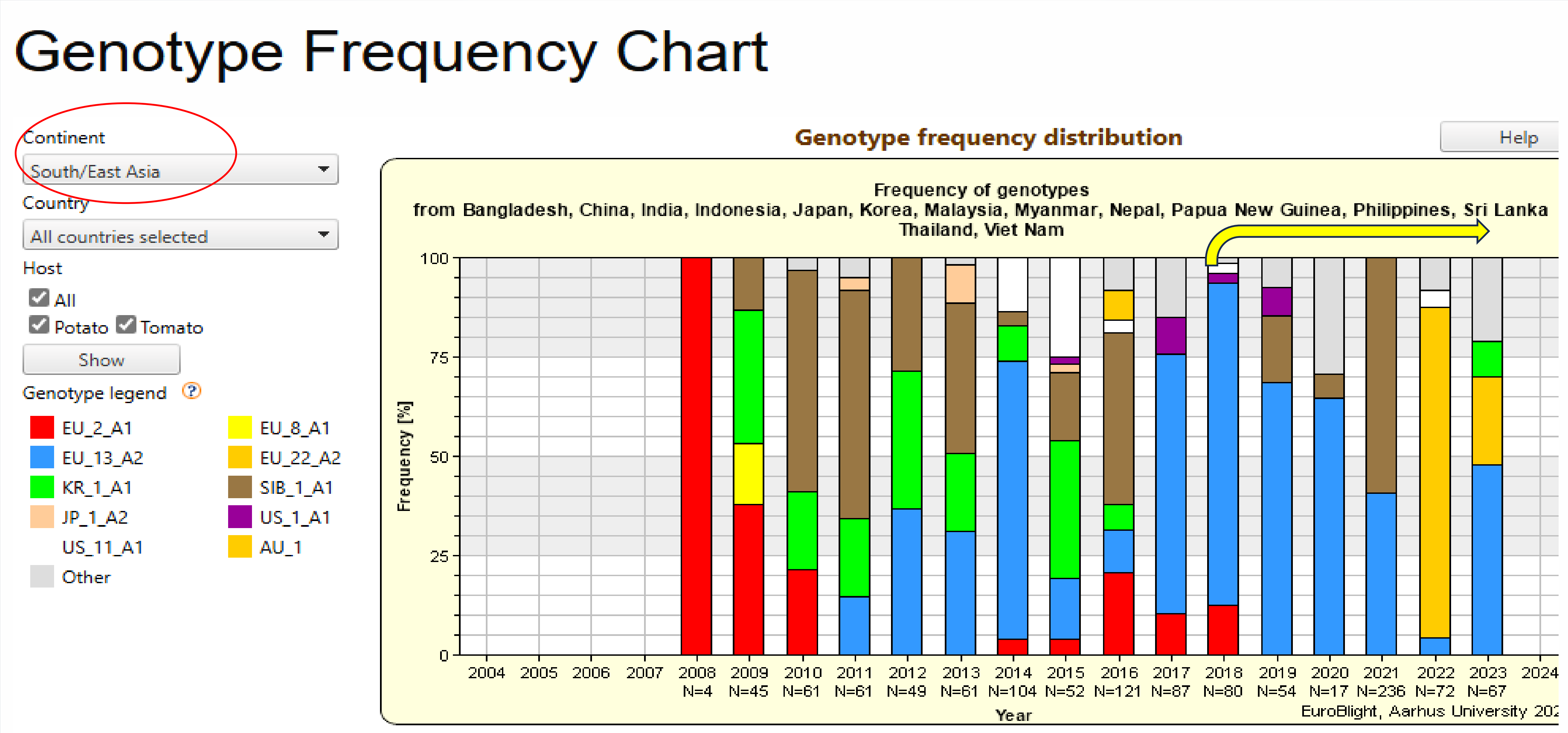
SECTIONS PDF TOOLS SHARE

➢ Genotype, EU43 increasing from 2% of the sampled European population in 2021 to 16% in 2022 expressing resistance to mandipropamid upto 1000 ppm and cross resistance towards dimethomorph. We must have our attention on this situationin in Asia

(Norway, Sweden, Germany, Portugal, Denmark, Netherland, Belgium)

Potato Late Blight Toolbox

https://agro.au.dk/forskning/internationale-platforme/euroblight/research-projects/ipmblight20/potato-late-blight-toolbox

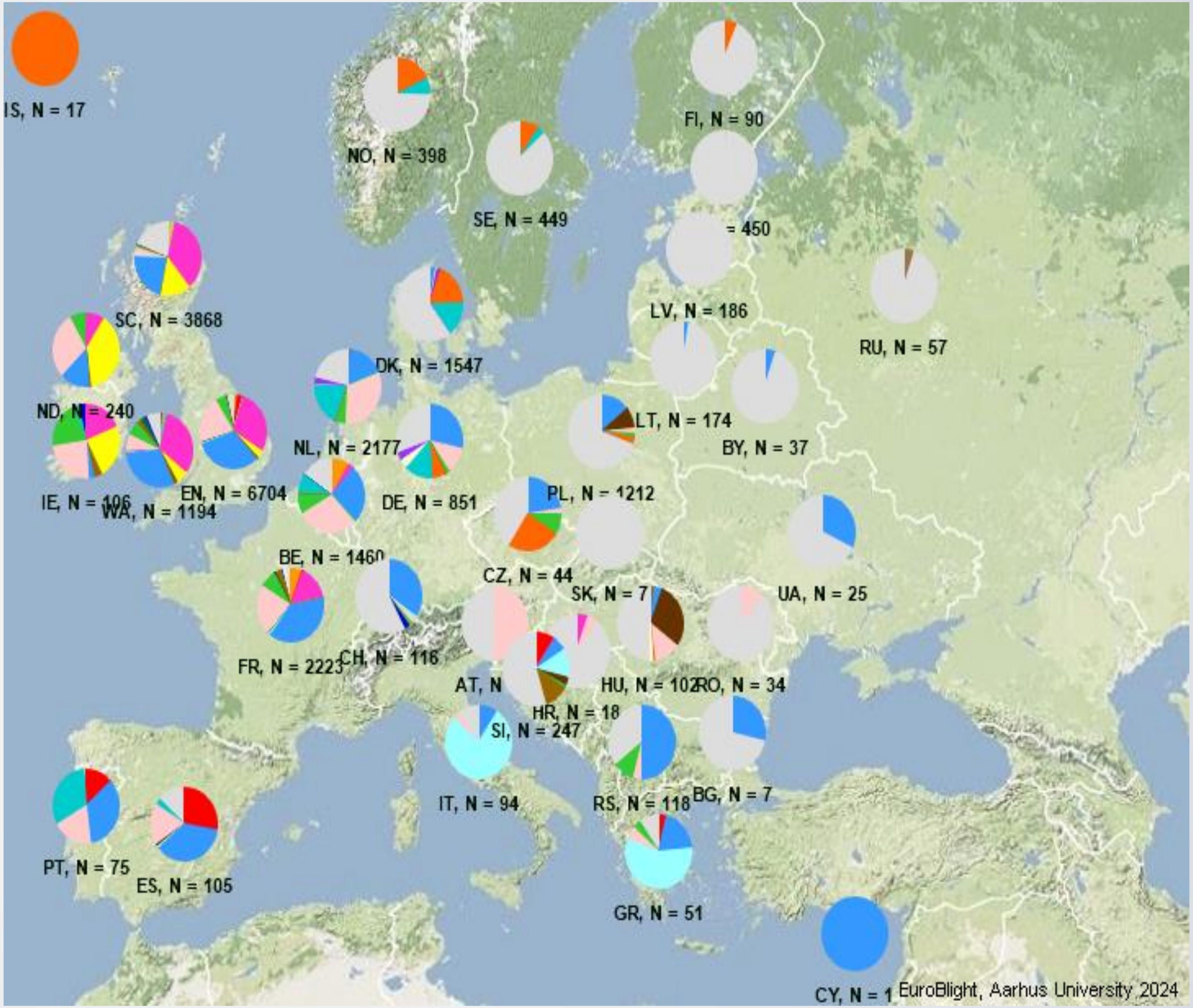


Euroblight Genotype Frequency 2004-2023

Show

Genotype legend ?

EU_1_A1	EU_2_A1
EU_3_A2	EU_5_A1
EU_6_A1	EU_8_A1
EU_10_A2	EU_12_A1
EU_13_A2	EU_23_A1
EU_22_A2	EU_33_A2
EU_34_A1	EU_35_A2
EU_36_A2	EU_37_A2
EU_38_A2	EU_39_A1
EU_40_A2	EU_41_A2
EU_42_A2	EU_43_A1
EU_44_A1	EU_45_A1
EU_46_A1	SIB_1_A1
Other	



Not sampled for AsiaBlight

<u>Armenia</u> & <u>Azerbaijan</u> (Western Asia)

<u>Bhutan</u> (South Asia)

<u>Myanmar</u> & <u>Thailand</u> (Southeast Asia)

<u>Taiwan</u> & <u>Hong Kong</u> (East Asia)

Progress for 2024 SAMPLE collection

2024 FTA cards detail

Sr#	FTA cards Send	FTA cards Received	Country
1	100	82	Bangladesh
2	30	15	Pakistan
3	30	6+1	Vietnam
4	10	NR*	Georgia
5	30	NR*	Philippines
6		30	China (Guo Mei)

NR* Not Received

We need assistance from representatives from other countries to send us back the FTA cards (diseased) for the smooth functioning of ABN

Asia-Blight: Challenges

- Obtaining samples across a large, politically diverse region

- National biosecurity legislation restricted opportunities for direct participation in some Countries
- Countries differ greatly in their organizational structures, political attitudes to regional co-operation, plant health legislation and so in their ability to participate

- But we are **PROGRESSING**

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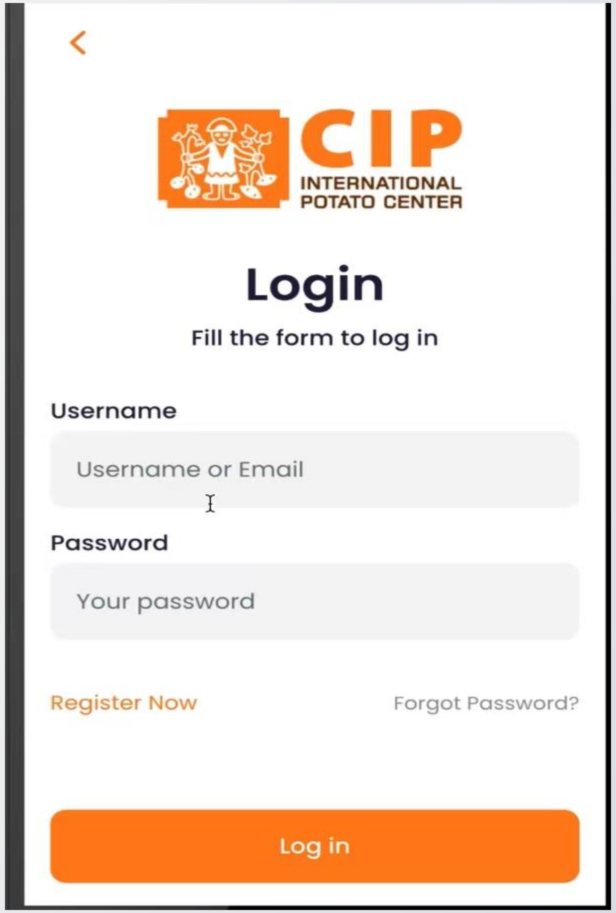
Next steps for activity:

- Started to write up for publication during 2024-25 with the analysis part being finalized by @David Cooke.
- Need to seek approval from collectors/owners whether genotyping data from their samples can be included?
- AsiaBlight is in process to launch an Mobile APP for tracking FTA card shipping and delivery. This can reduce data collection errors (i.e., GPS and photo identification of sample collected) and provide a real time count of in-region FTA cards.

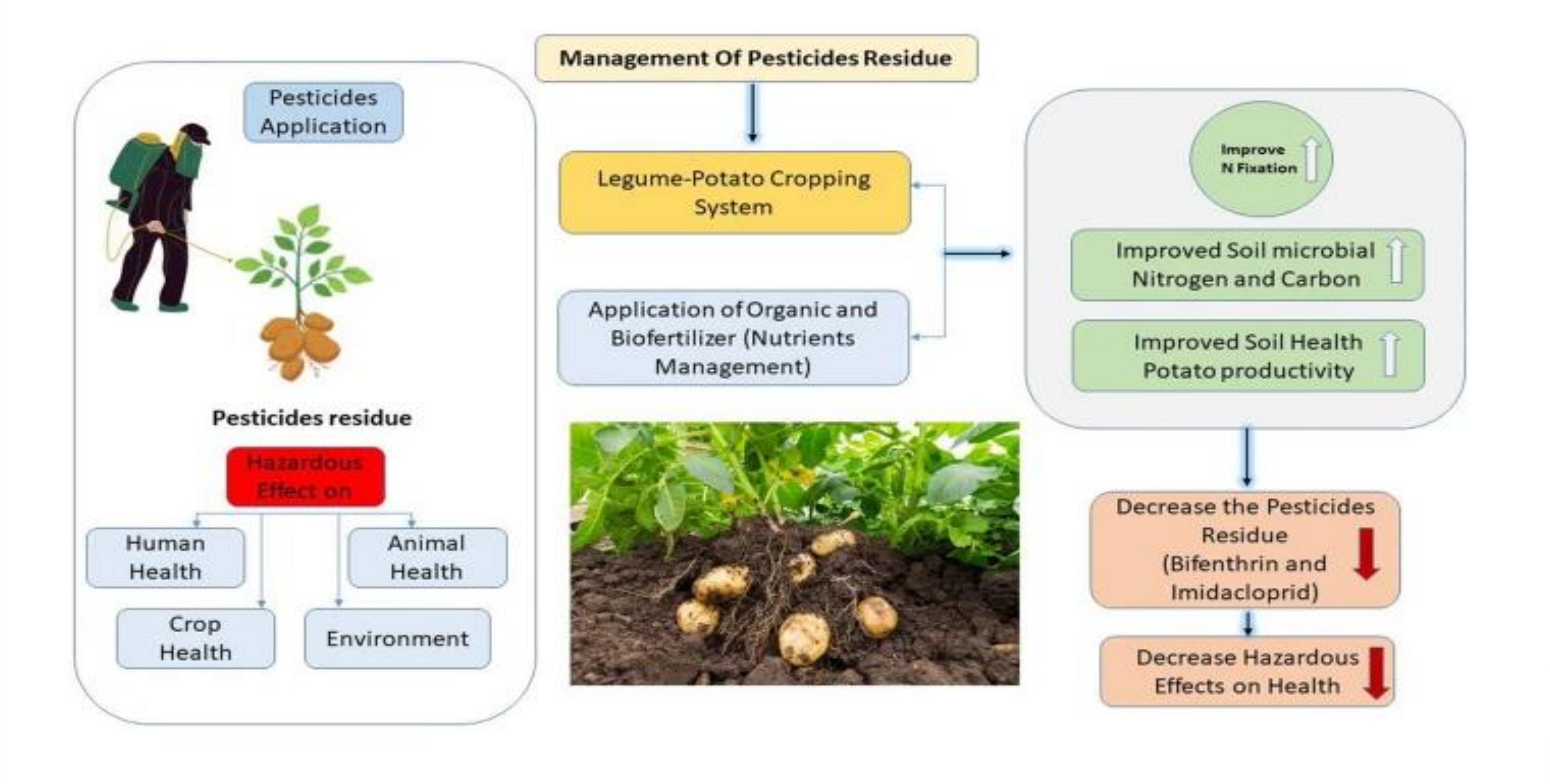


- Developing sense of collaboration among regional representatives.
- Intentions to involve private sector partners from Pakistan into ABN.
- Begin genotyping for the remaining 2024 PLB samples at Yanqing after the conference concludes.
- What is the effect of significantly changing *Pi* populations on the efficacy of the fungicides to control potato late blight?

In progress, co-ordination with Dingxi Jinlin Seed industry, China for pilot project in Pakistan.
All other seed companies are welcome to contact for further discussion.

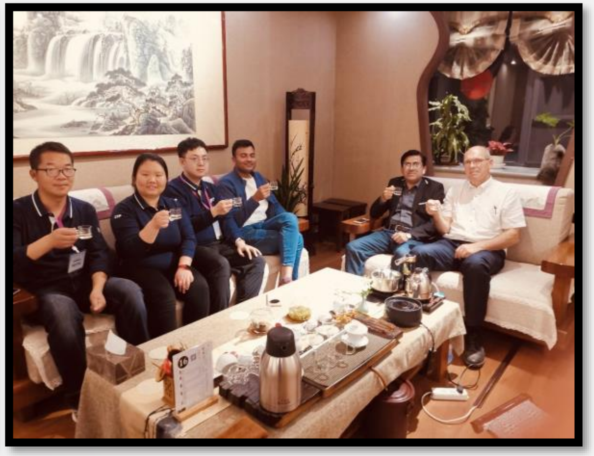
This could be Next Plan

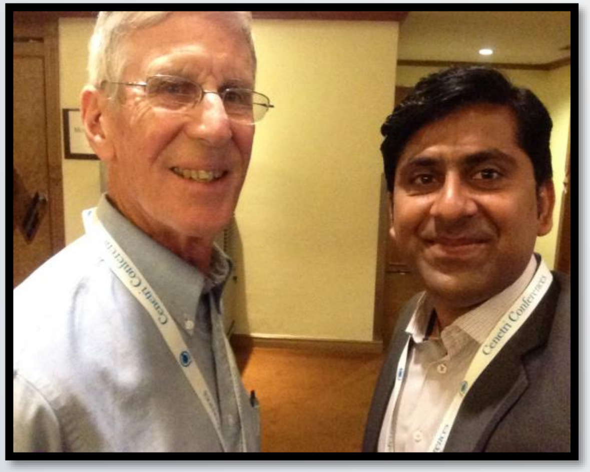
Ahmad et al., 2024



OF CHINA'S FAVORITE POTATO (AALU) EXPORTERS
(JANUARY TO APRIL)
, and corn
mption and seed production
17 kg
75% market share)
arket share)
(15-20% market share)

CENETRI
Publishing Group





AsiaBlight
2023 年亚洲马铃薯晚疫病协作网工作会议
Annual Meeting of AsiaBlight Network for Year 2023
2023年12月17日-18日
河北·保定

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  - **Japan:** Seishi Akino
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  - **Korea:** Jeomsoon Kim
  - **Kyrgyzstan & Tajikistan**: Saltanat Mambetova
  - **Nepal:** Ram Bahadur Khadka
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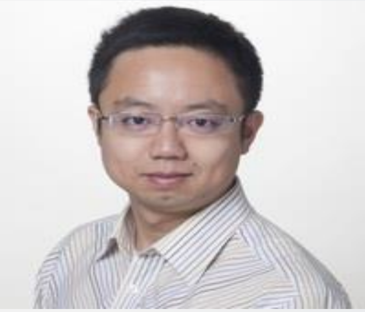


Dr. Louise Cooke (Late)

Prof. Dr. Muhammad Usman Ghazanfar
University of Sargodha

Prof. Dr. Sumeong Dong
Nanjing Agricultural University

Dr. Philip Kear
The International Potato Center-China
Center for Asia Pacific (CCCAP)

Higher Education Commission of Pakistan
Islamabad, Pakistan

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CIP-AsiaBlightContact@cgiar.org

William Earl Fry
Asia-Blight Advisor

Meet the AsiaBlight Team

https://www.asiablight.org/the-team/

Dr. Waqas Raza
Email: waqasraza61@yahoo.com
WeChat Id= Phytodoctor61
UAN# +8617871990858