A Review of Metalaxyl Resistance in *Phytophthora infestans* from Pakistan

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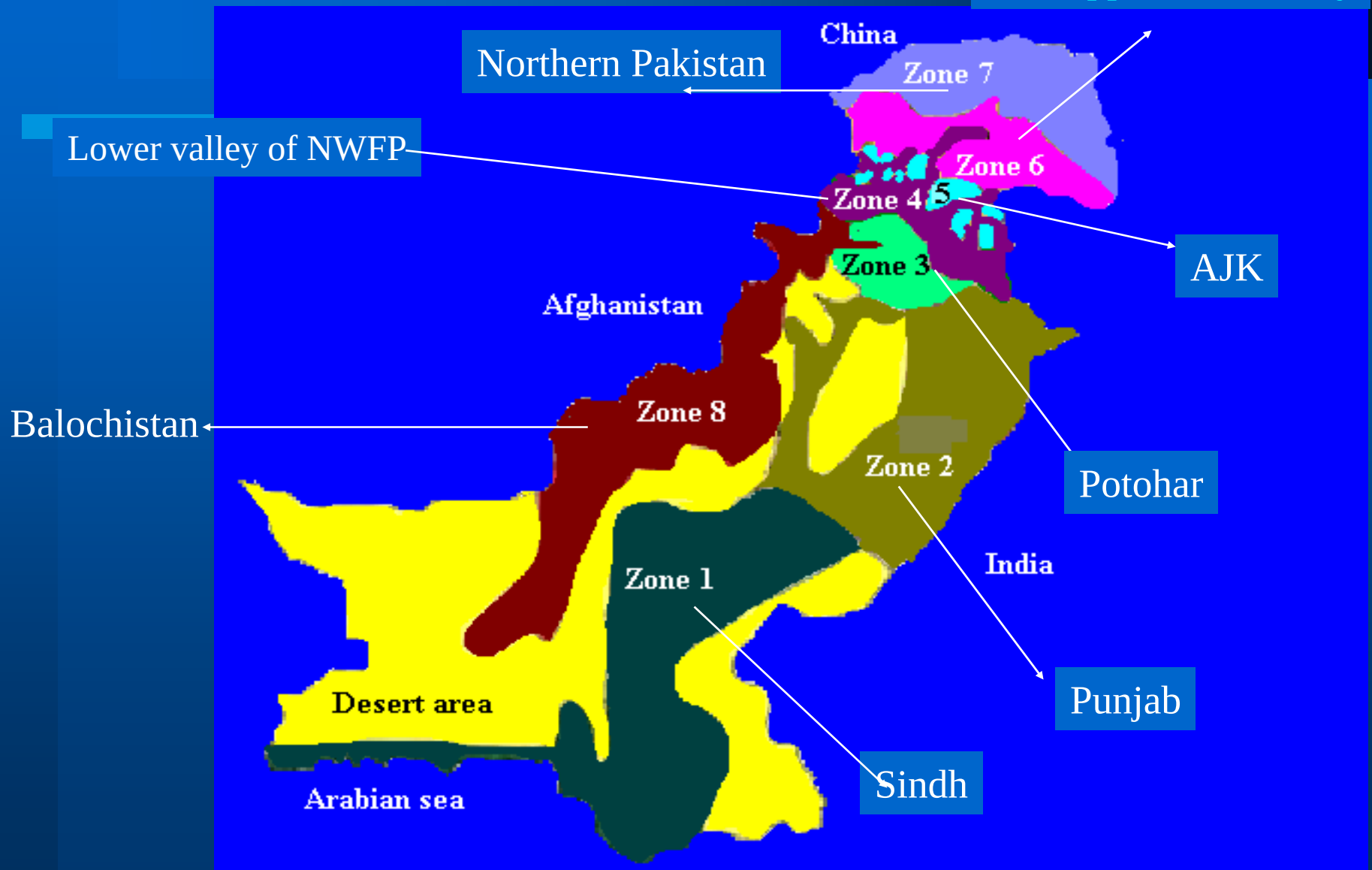
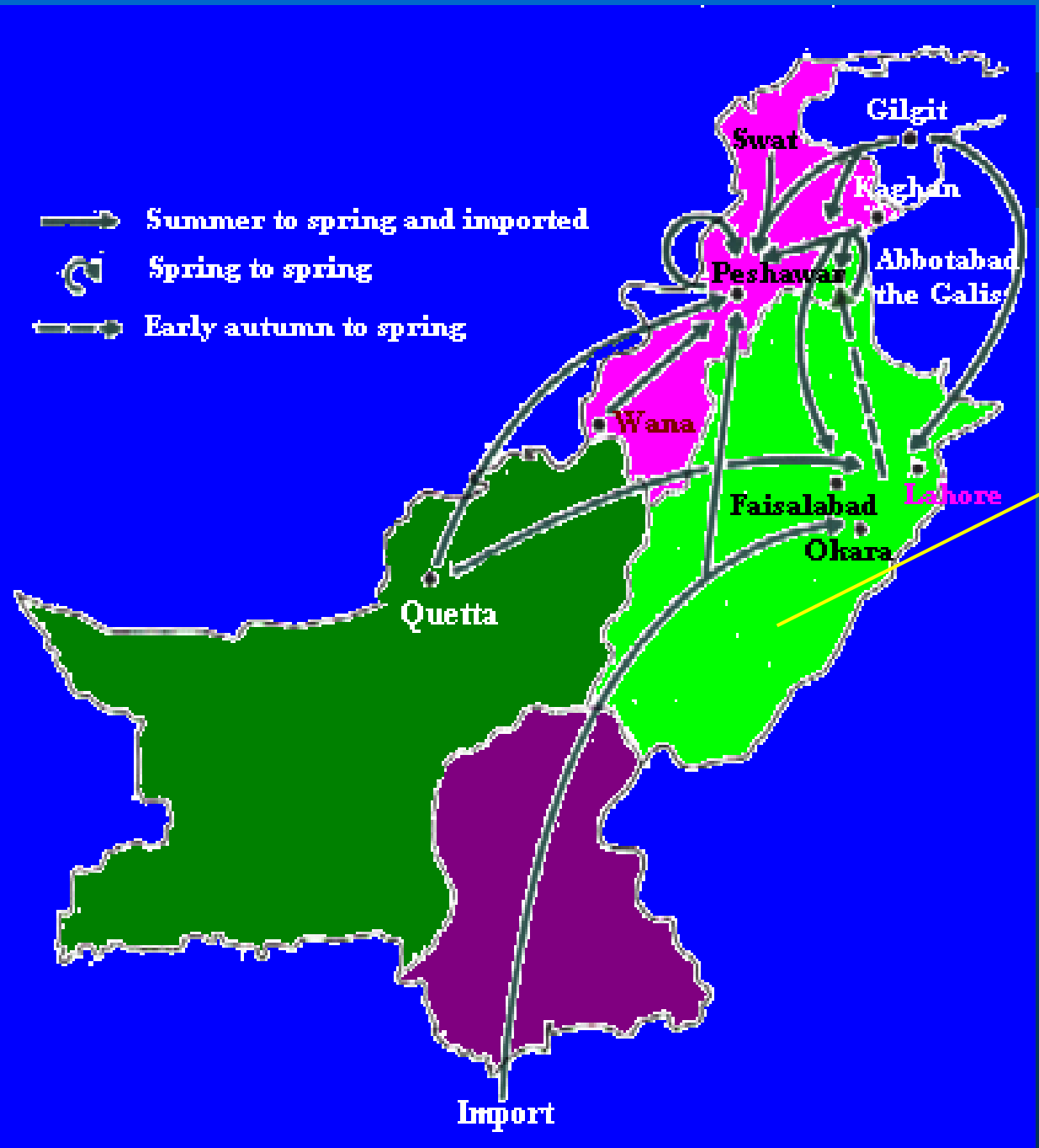
- Potato ranks Fourth
- Source of energy
- Per acre yield
- Diseases of Potato
- Late blight reported in 1984 Kalam & Malam Jaba
- Presence of A2 mating type confirmed in 1995
- Presence of two mating types effect on disease epdemiology.

Late Blight Occurrence Areas

a. Kaghan valley
b. Upper Swat valley



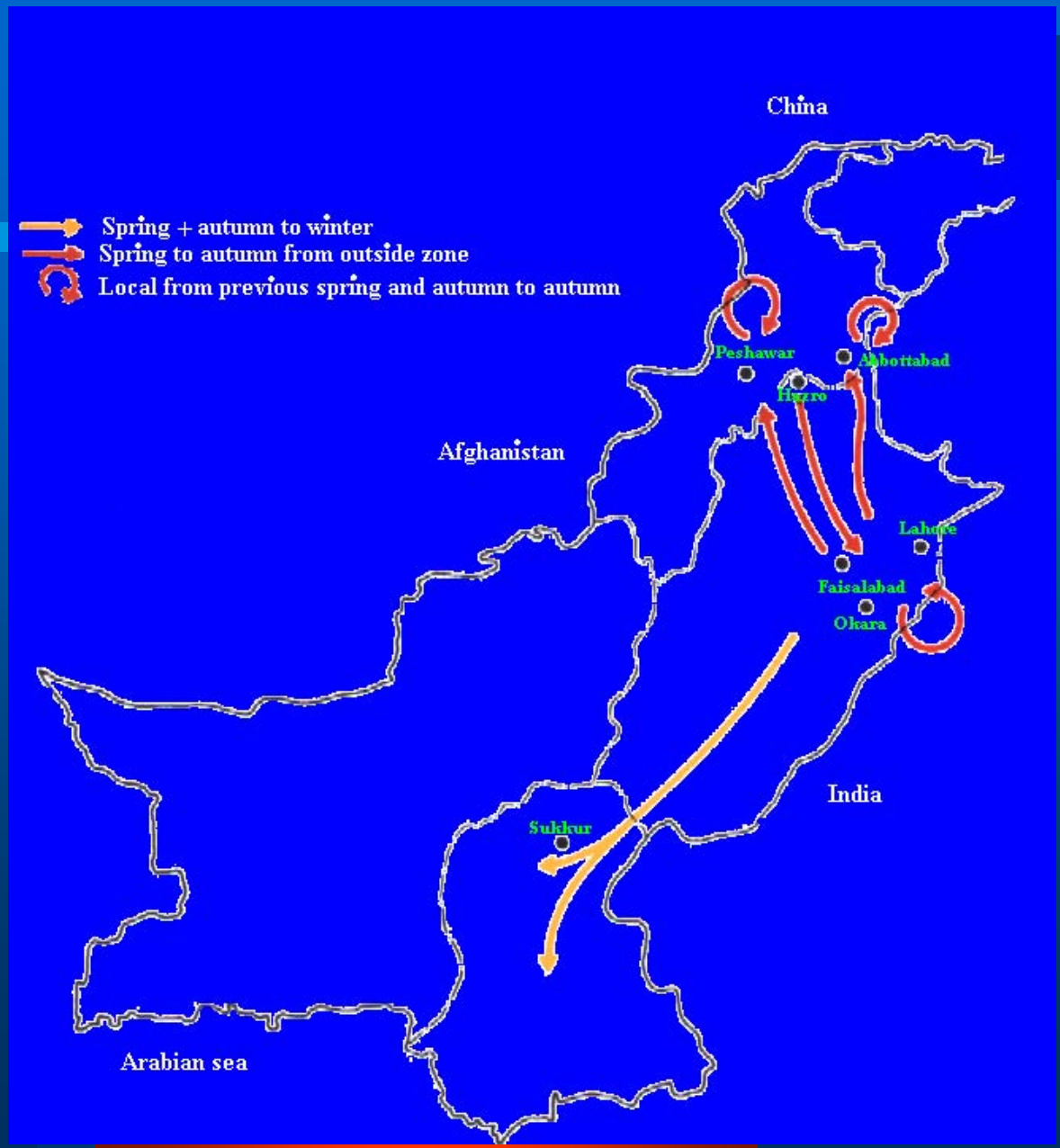
Main seed flows for planting the autumn spring, and summer potato crops in Pakistan



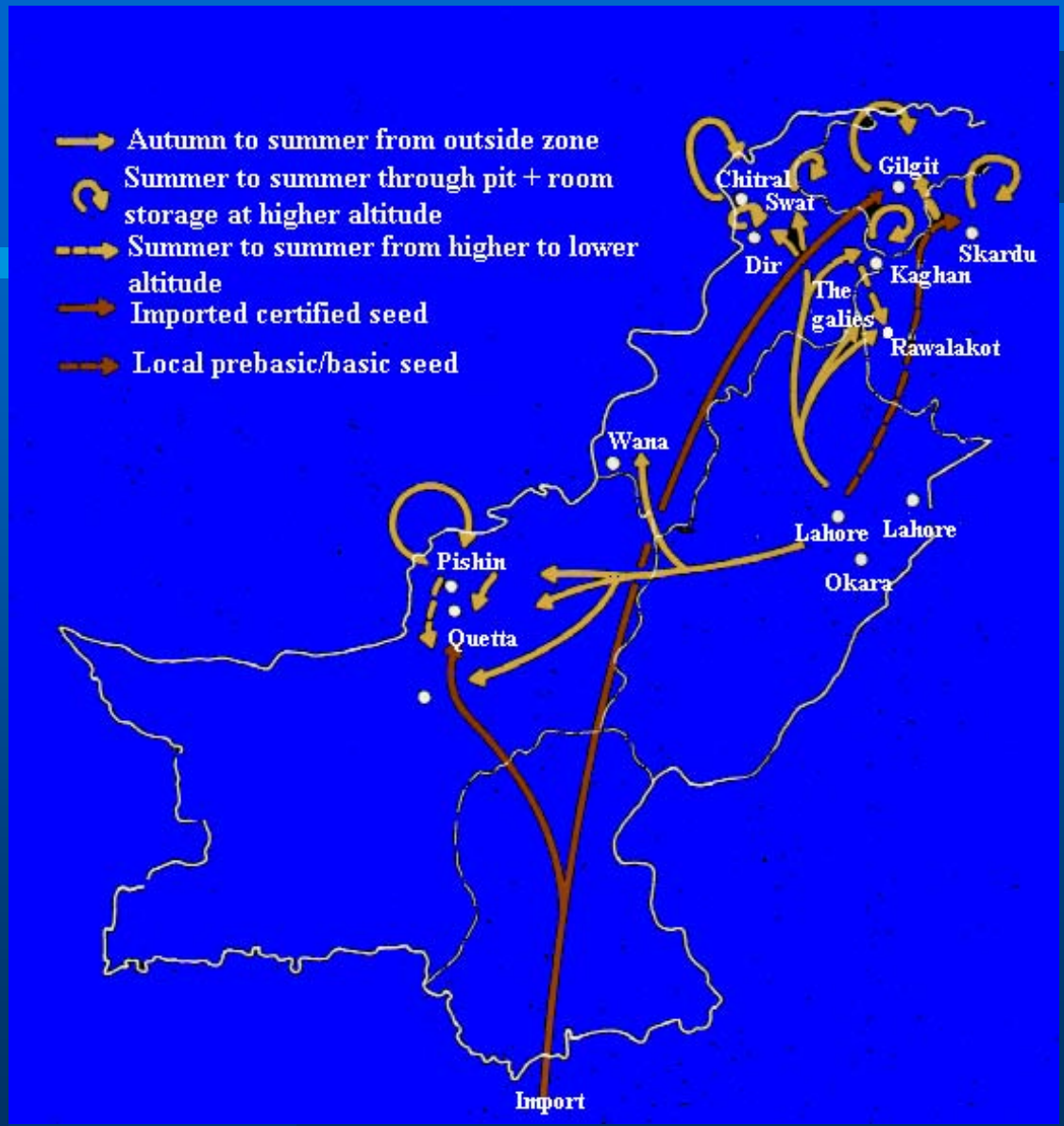
Punjab (Zone 2)

- Hot
- Heavy rain (moonsoon)
- Frost in winter
- Suitable for autumn crop
- Spring crop & seed source
- Imported seed
- Certified and uncertified seed

NWFP (Zone 4)



- Flood plain
- Valley bottom & rolling hills
- Autumn and spring crop
- Seed come from Punjab



AJK (Zone 5)

- Rain fed valley
- Hill slides
- Seed transfer from zone 2 to 4, 5, 6,7, 8
- Disease reported in Balochistan & Northern Pakistan

Metalaxyl Sensitivity Analysis

Sensitive **Control**

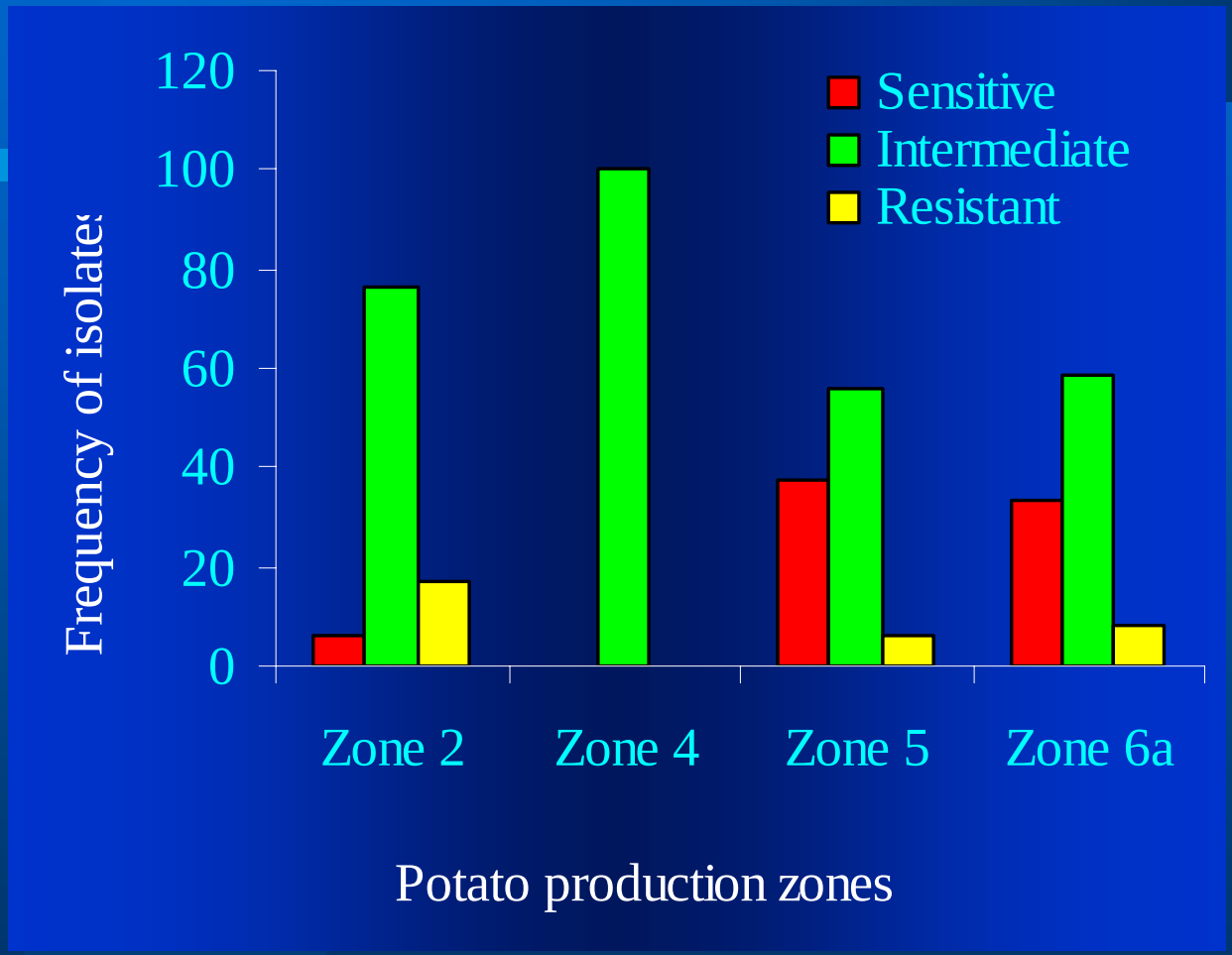
- Rye agar medium
- In control (DMSO)
- Temp 18C
- 15-16 days

Intermediate **Control**

Resistant **Control**

Shattock (1988).

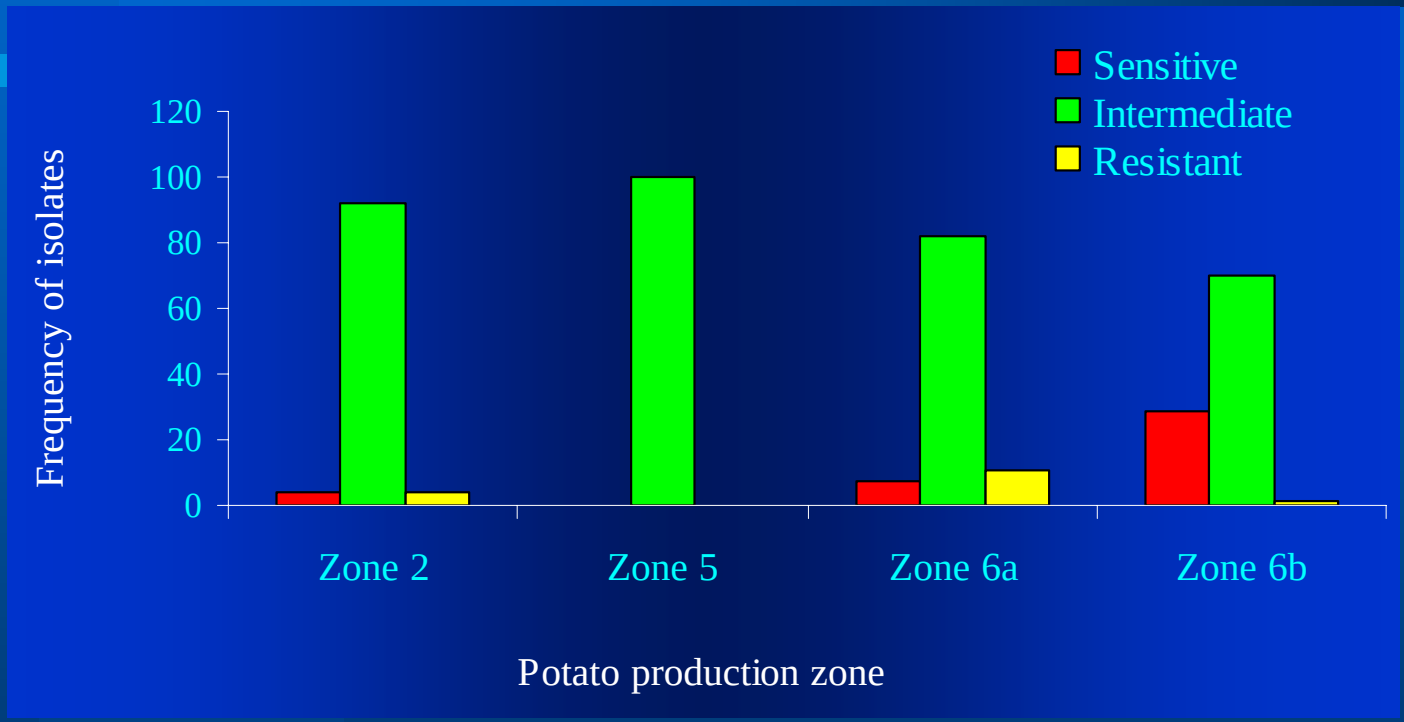
Metalaxyl Resistance 1997-1998



- Frequency of intermediate was higher

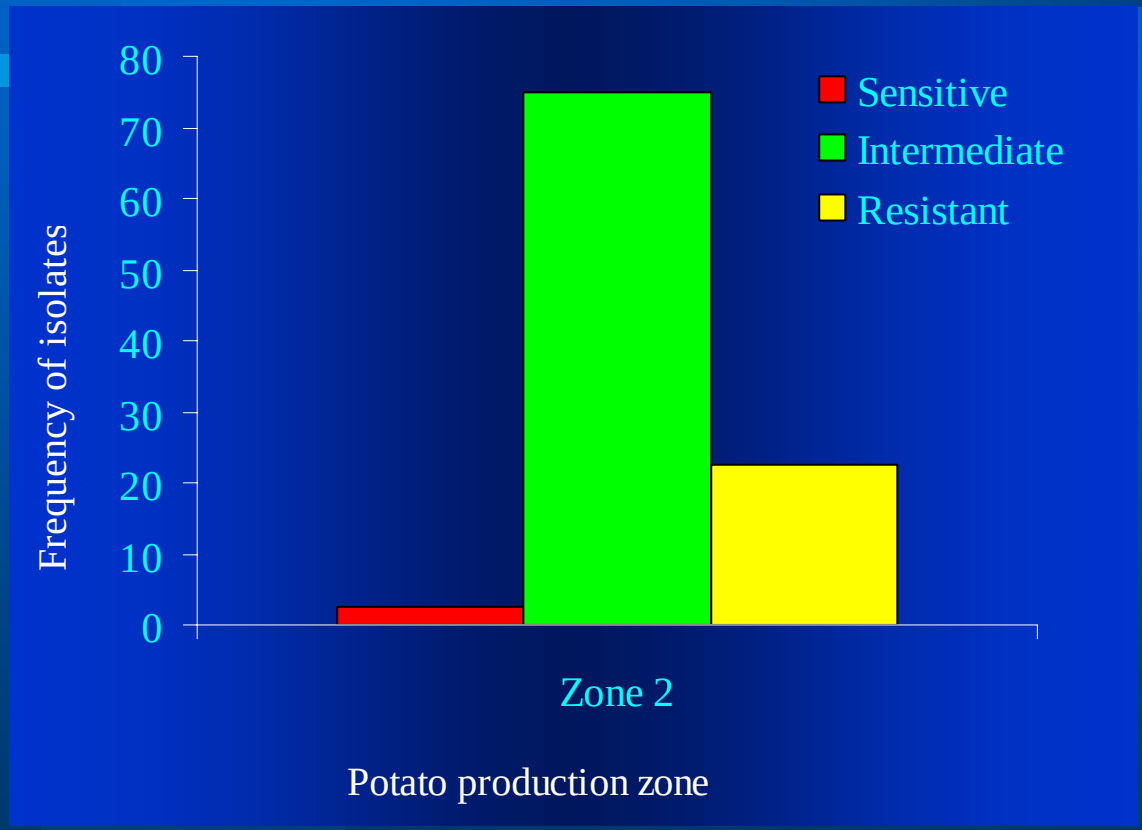
Zone 2	Punjab
Zone 4	Lower valley of NWFP
Zone 5	AJK
Zone 6a	Kaghan valley

Metalaxyl Resistance 1998-1999



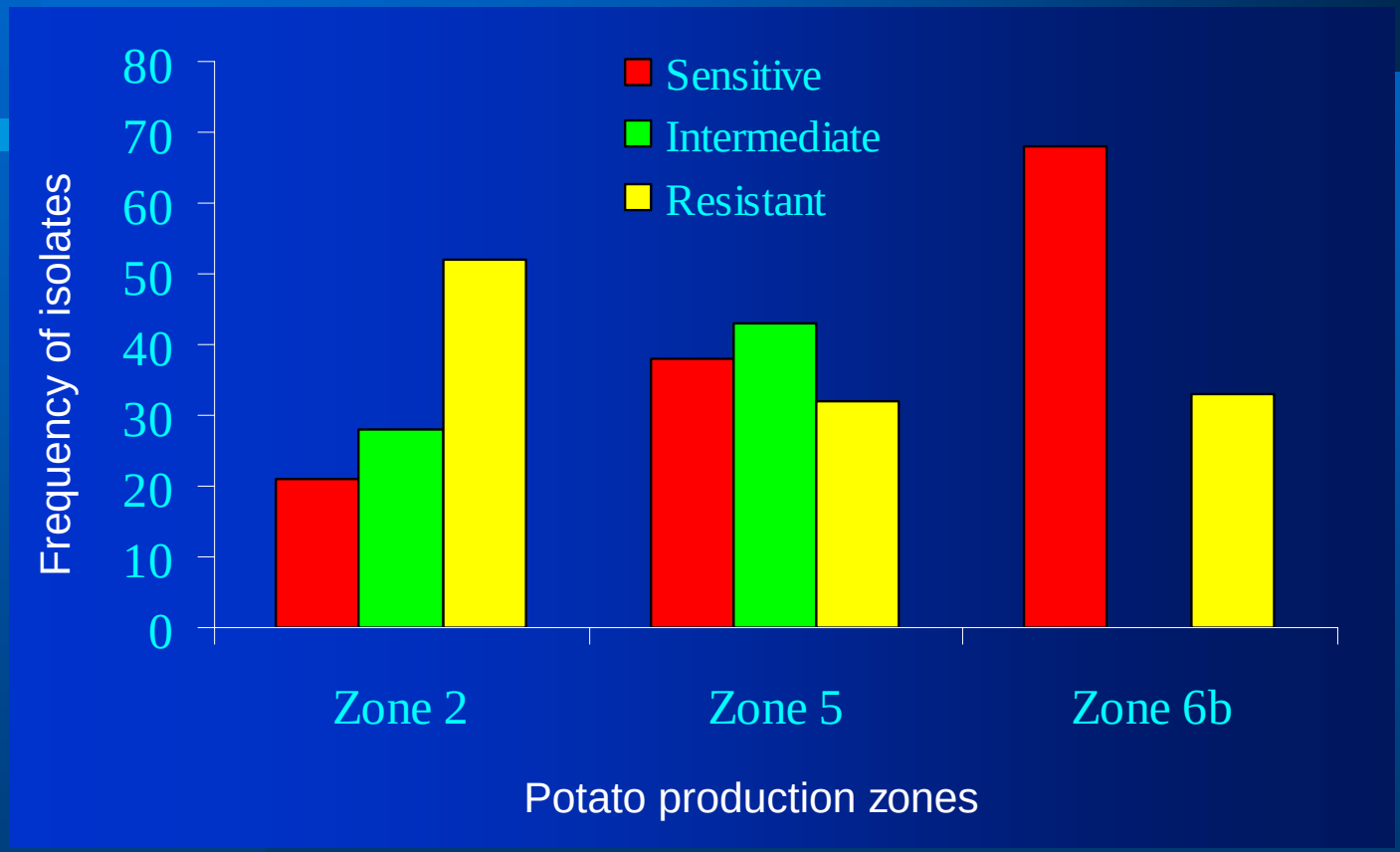
Zone 2	Punjab
Zone 4	Lower valley of NWFP
Zone 5	AJK
Zone 6b	Upper Swat valley

Metalaxyl Resistance 1999-2000



Zone 2 Punjab

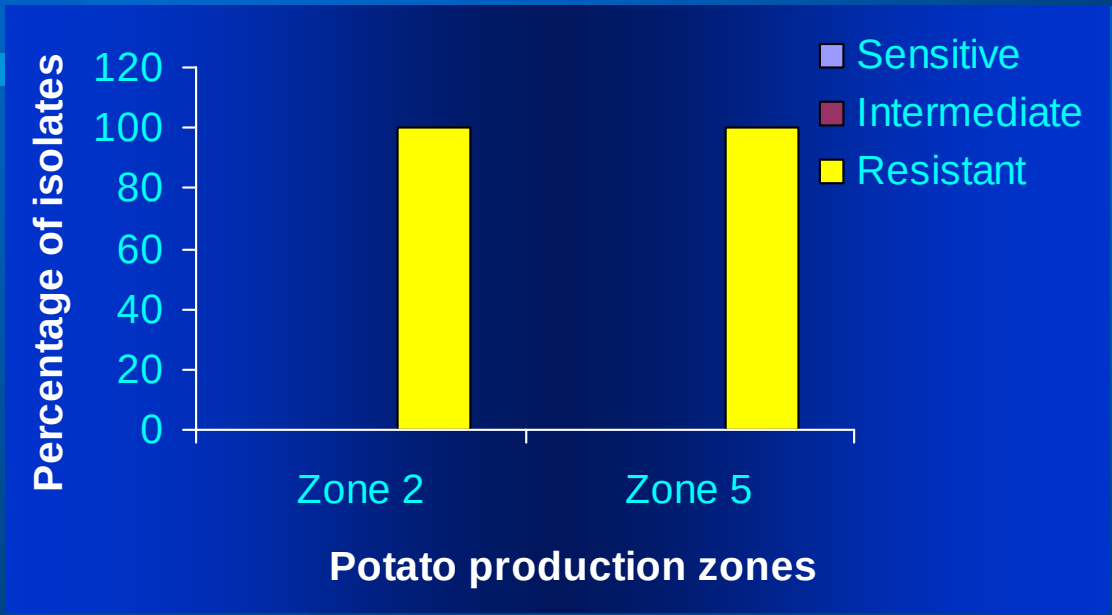
Metalaxyl Resistance 2003-2004



Zone 2	Punjab
Zone 5	AJK
Zone 6b	Upper Swat valley

- Excessive use of fungicides
- Genetic mutation

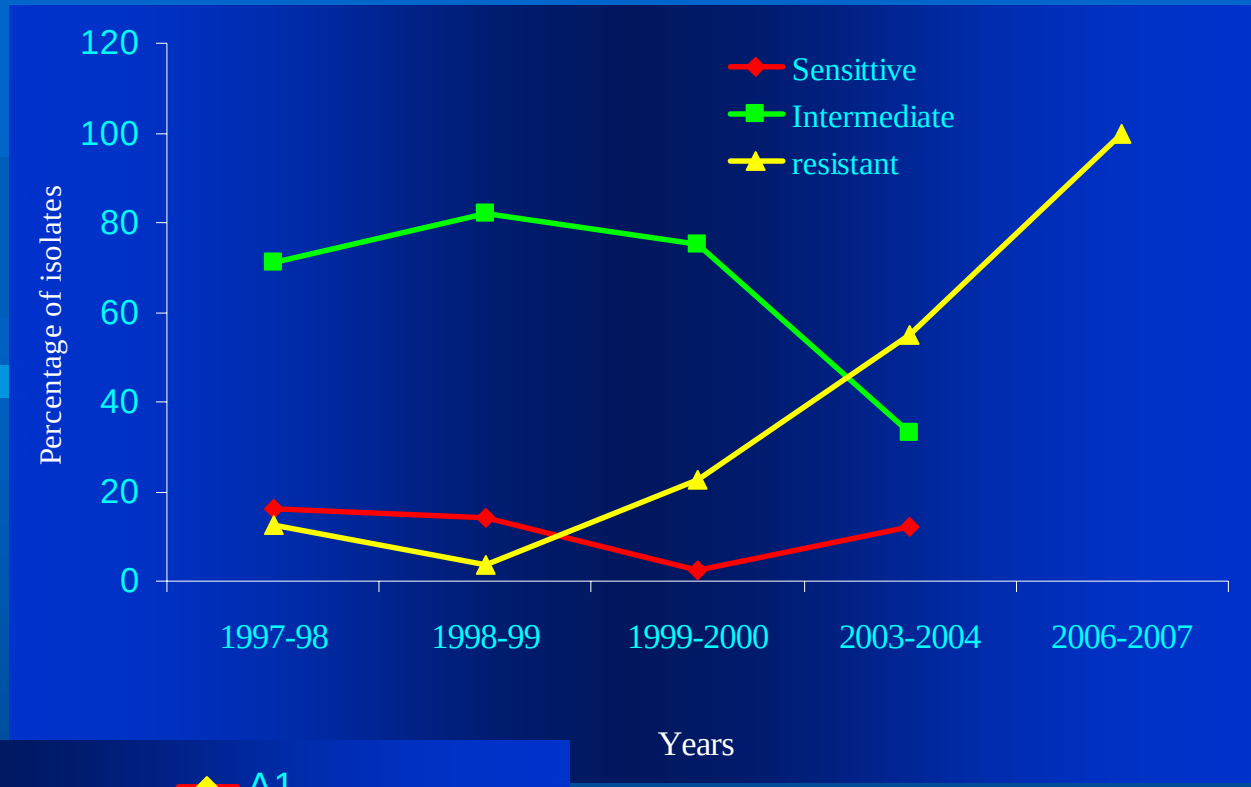
Metalaxyl Resistance 2006-2007

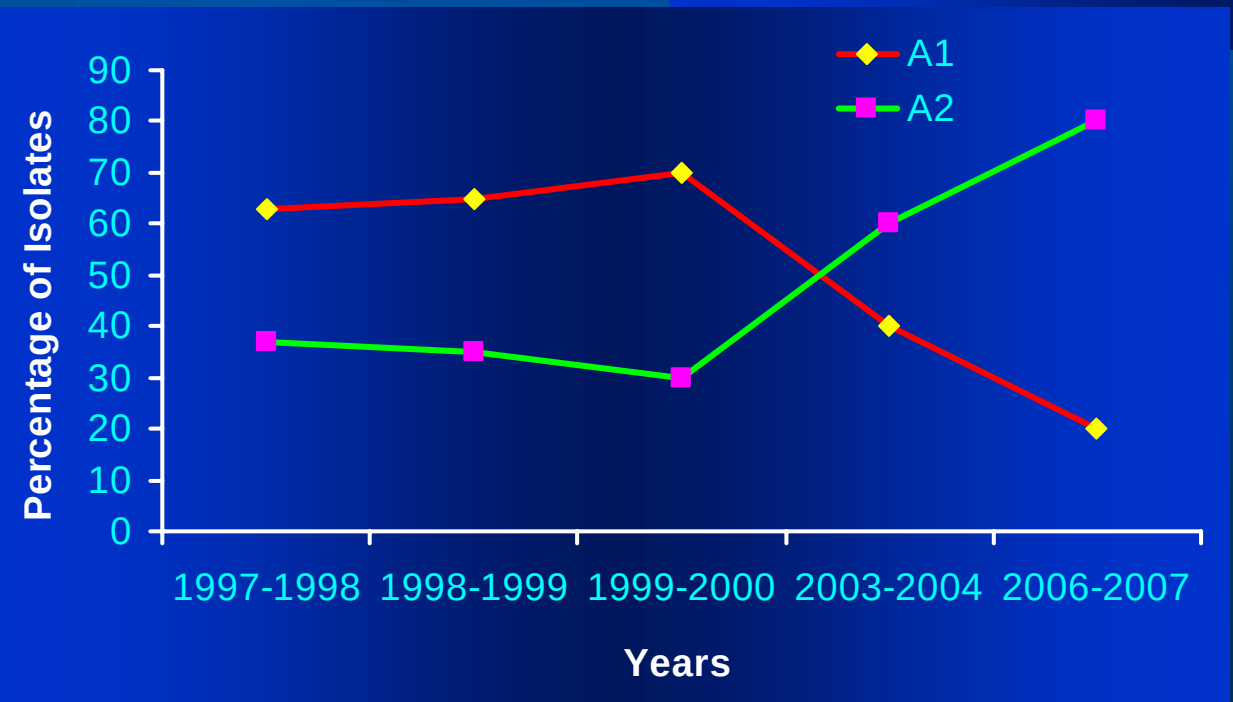


Zone 2 Punjab

Zone 5 AJK

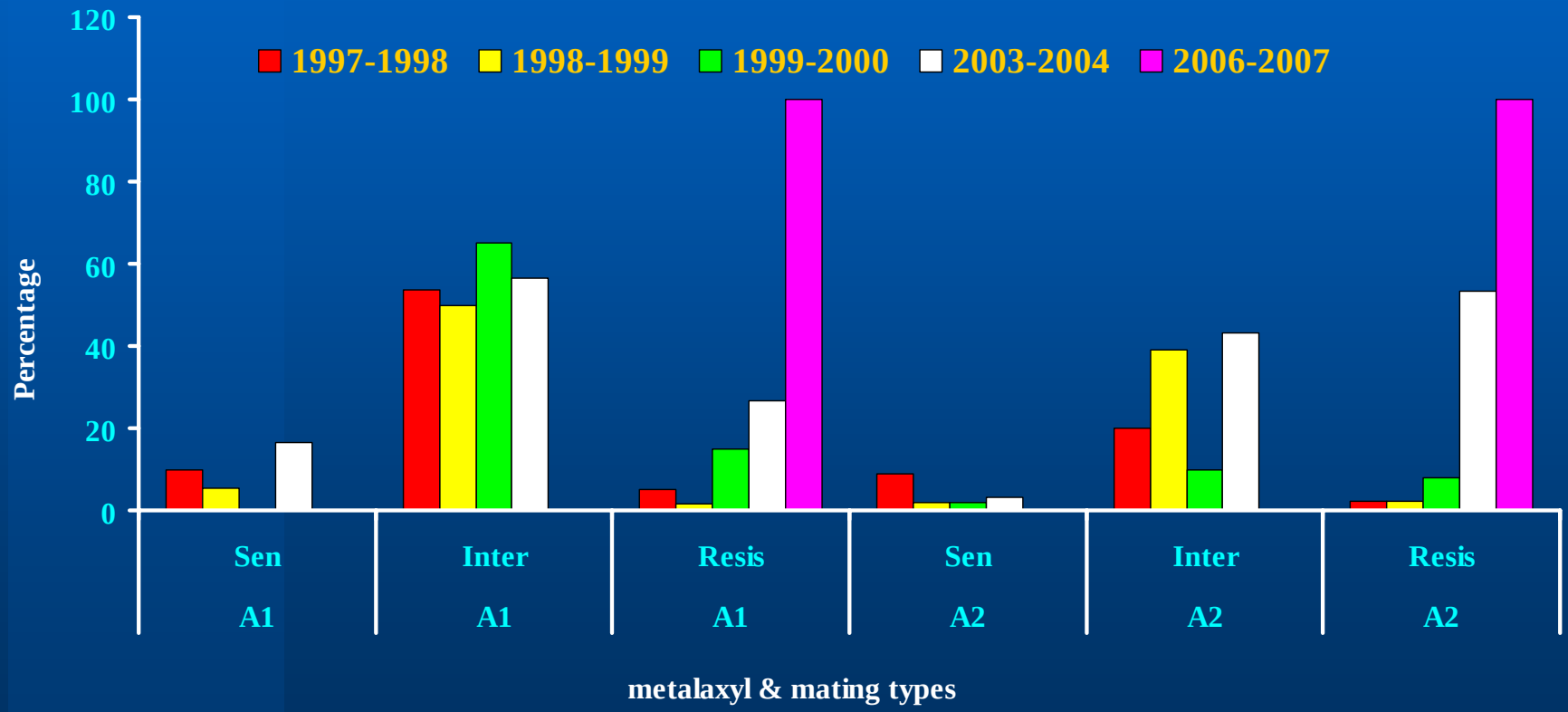
Metalaxyl Resistance 1997-2007





Mating types 1997-2007

Distribution of metalaxyl sensitivity in A1 & A2 mating type of *P. infestans* from 1997 to 2007.



Conclusion

- Intermediate resistant strains were dominant from 1997-2000.
- Metalaxyl resistance was dominant from 2003-2004.
- All population was resistant during 2006-2007
- Accumulation of metalaxyl resistant alleles by the application of metalaxyl based fungicides as well as possible carrying of metalaxyl resistant genotypes with imported seed particularly in zone 2 & 4.
- Further detail analysis of *P. infestans* metalaxyl resistant is essential for the presentation of clear picture

Thanks and Acknowledgements

Thank You for Your Attention

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GILB