Improvement of new fruit tree cultivars and usage of genetic markers for characterization and maintenance of plant breeders rights

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New improved deciduous fruit cultivars raise the difficulty of rights protection

- Our unit at Newe Ya'ar Research Center, ARO improves new deciduous cultivars such as pomegranate, almond and apricot
- 5 new pomegranate, 6 new apricot and 5 new almond cultivars were released. Five of these are now the main cultivars grown in Israel
- All are registered for Plant Breeder's Rights in Israel and some in other countries such as USA and Europe

How can we protect these rights by molecular methods?

A glimpse at this subject complexity

Two examples are given in this lecture to demonstrate portion of the complexity of molecular usage in cultivar protection

- SNP and SSR markers for pomegranate
- Genetic mapping in almond

Molecular technology is used for both: -

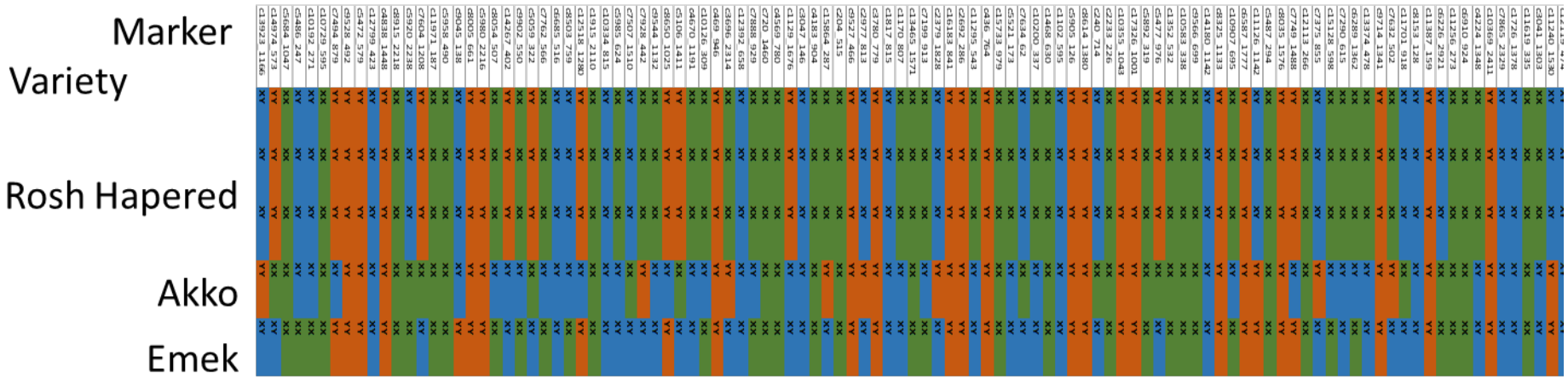
Improvement (is now a routine)

Protection - in progress and there are achievements

Pomegranate cv Emek

- In order to improve pomegranates while using local varieties, a selection was made in seedlings of the Israeli variety Akko. Male parent was unknown
- Emek cv is very early, sweet, dark red to pink, red arils, soft seeds, big, productive

350 SNP markers were established for the Newe Ya'ar pomegranate collection



The SNPs revealed that Rosh Hapered is the pollen donor

Today there are 5000 SNP markers that contribute to the accuracy of the identification of a cultivar

SSR for pomegranate identification

Variety	SC28915	SC7483	sc106926	16196
Akko	236/230	268/270	252/252	133/133
Shani-Yonay	236/236	268/270		133/133
Emek	236/236	270/270	248/252	133/139
Rosh Hapered 1	236	270	248	
Rosh Hapered 2	236	270	248	

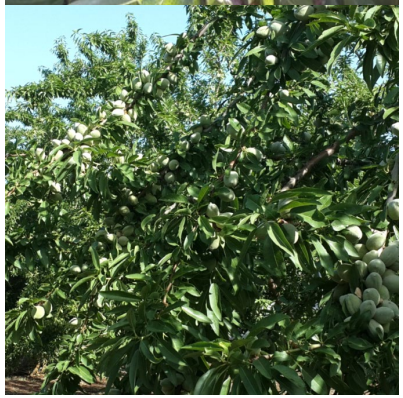
- This varieties have many common characteristics
- Just 4 SSRs can differentiate them

more SNP markers will allow better identification

Almond cv Matan

- Using the local variety Um ElFahem and a self fertile cultivar we selected cv Matan
- Almond improvement objectives are: self fertile, large attractive kernel, good taste, high yields, balanced tree structure, suitable for hot climate
- Matan cv holds all these traits!

Self fertility *Sf* allele was used for gene assisted selection but is not enough for cultivar protection



Breeding process of cv Matan

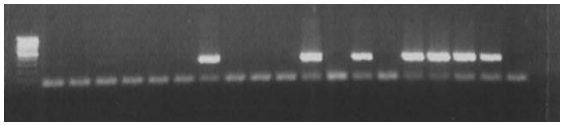
Self compatible almond cultivar (*Sf* allele)

High quality local old almond cultivar ('Um ElFahem')

Crossbreeding

PCR identification of *Sf* allele in F1

a bcd e f g h i j k lmn opq r s t

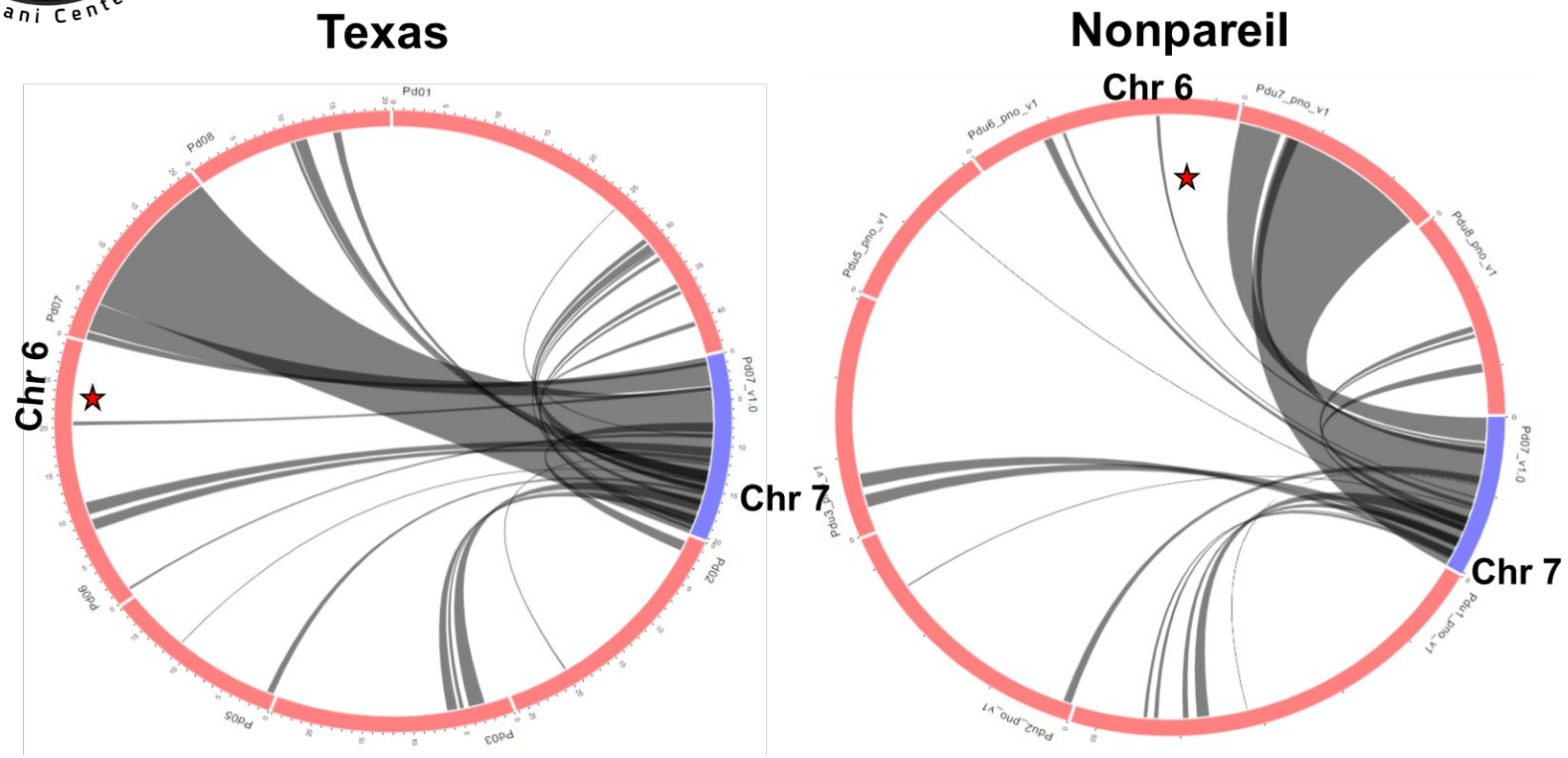


Planting only *Sf* positive seedlings

Selection for high quality cultivars

Commercial usage

Major structural genomic variation between almond cultivars



Variance among cultivars is challenging the usage of genetic markers and necessitates *de novo* genomic sequencing

https://www.rosaceae.org/synview