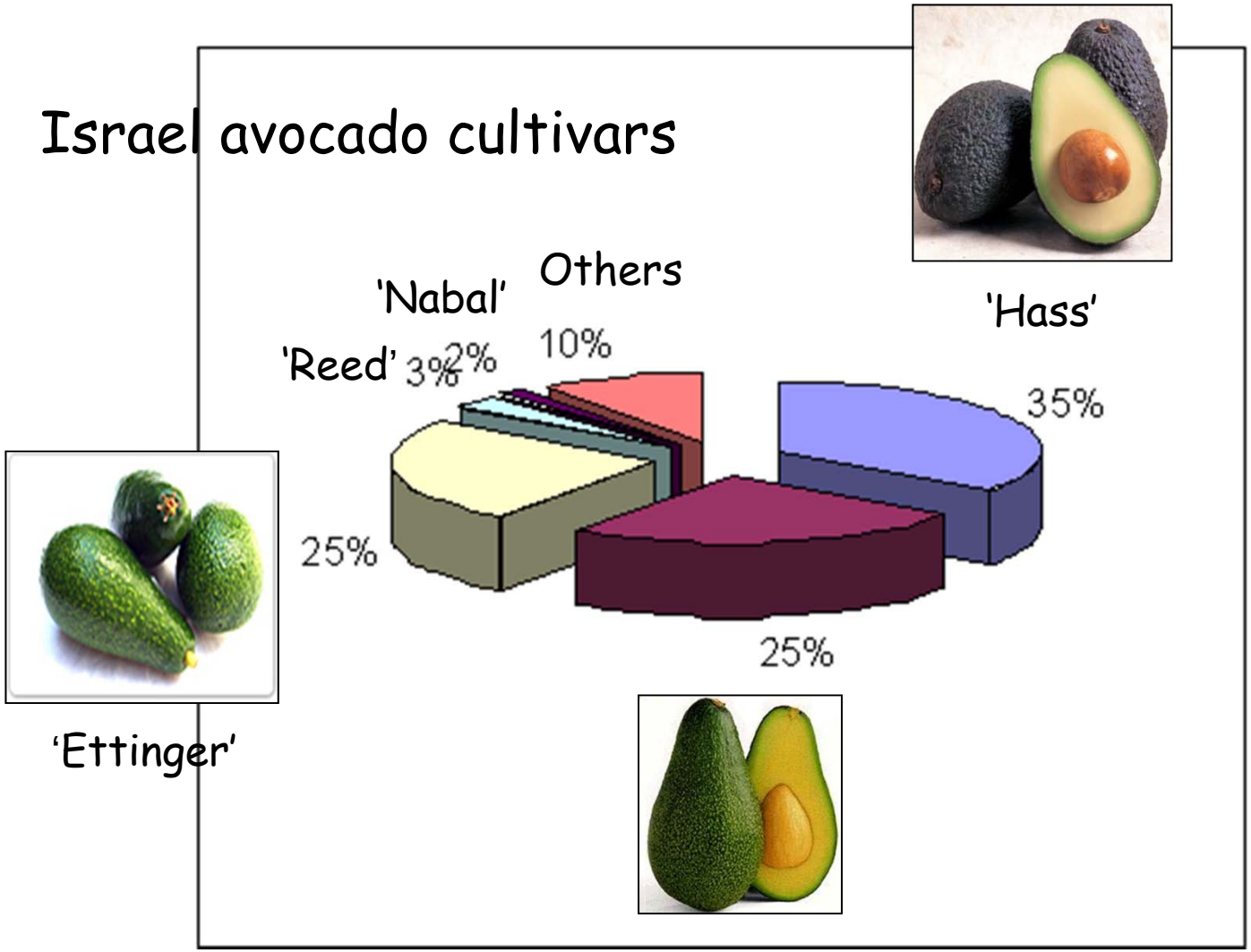
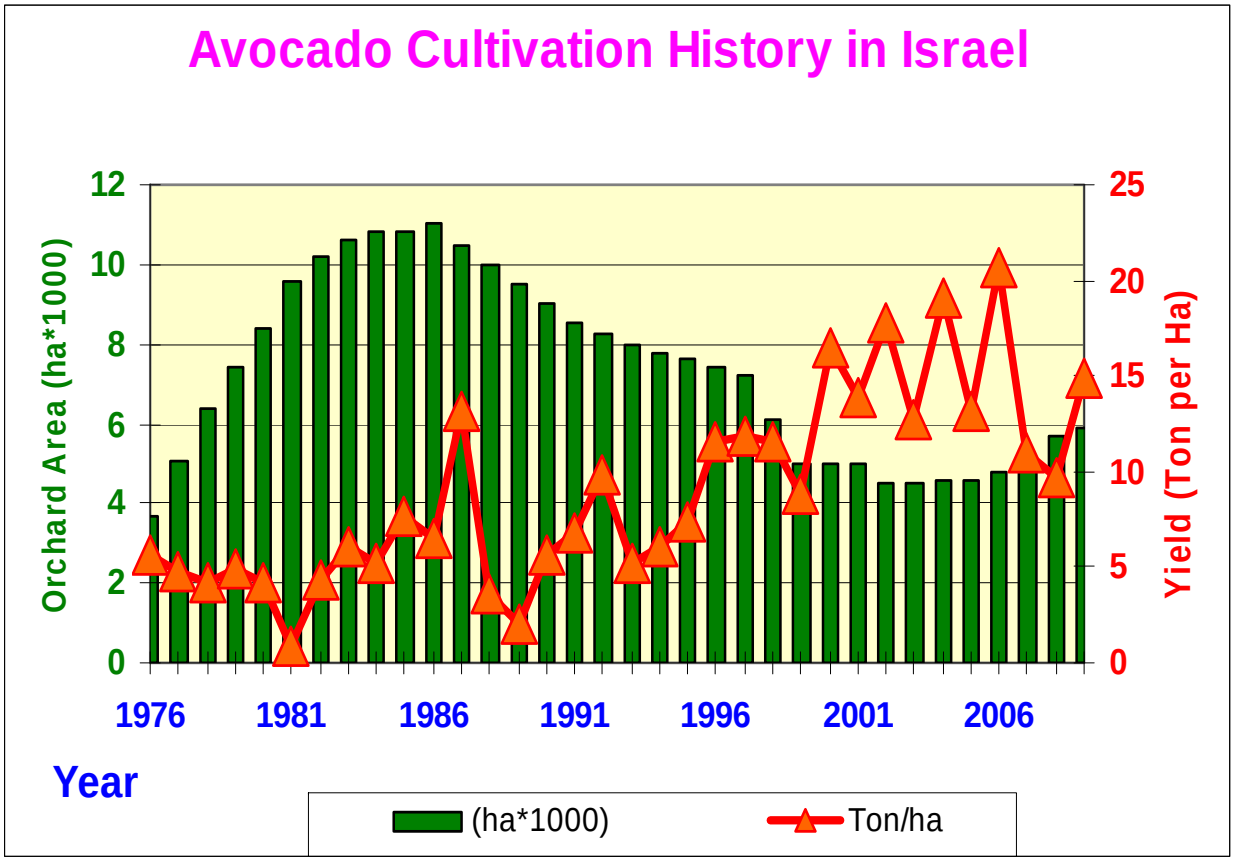
The Israeli Avocado breeding program – past, present and future



Avocado plantations 2011 65,000 Dunams

Average yield increasing :



2000 and later: average yield has been stabilized around 14 ton/ha.

1995 - 1998: average yield of 10 ton/ha.

1970 - 1994: average yield of 6 ton/ha.

2011 +/- 65,000 Dunams

Avocado Breeding project objectives :

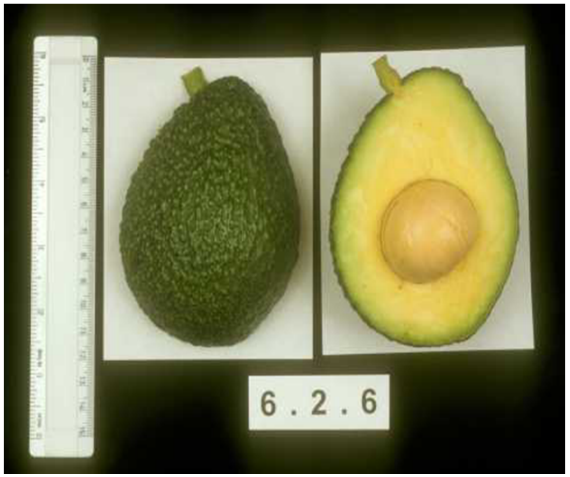
1-Select new avocado cultivars superior to 'Hass' in productivity, fruit size, performance and stress tolerance ('Hass-like' cultivars).

2-Select early and late season, green skin new cultivars.

Products released from the breeding program:

'Iriet' (Lahav et al., 1989)
'Galil' (Regev et al., 1998)
'Arad' (Lahav et al., 2005)
'Lavi' (Regev et al., 2005)
'Bar' (Regev et al., 2011)
'Moti' (Regev et al., 2011)
'Naor' (Regev et al., 2011)

'Hass'-like cultivars



'Lavi'

Found to be especially interesting for being 'Hass' like in its form with a larger fruit.

Productivity of 'Lavi' is good 20t/ha.

Smaller tendency toward alternate bearing than 'Hass'.

The seed is small (6-12% of final fruit weight).-

Buttery texture and good taste.

Harvest season Jan- Mar.

'Naor'

'Hass' like in its form but with larger fruit. (335 g).

Excels in early productivity, high production and low tendency for alternate bearing.

Peel separation of the ripe fruit is very good.

The stone is small (13-17% of the fruit weight).

The flesh is yellow-green, good nut-like taste.

Harvest season from Dec to Mar mainly Jan-Feb.

Green- skin new cultivar

'Galil'

Good producer and has low tendency for alternate bearing.

Fruit color is light green and weight averaging 280g.

The mature fruit remains green till ripening.

The thin, leathery peel separation from the flesh is difficult.

The flesh is light-yellow with a narrow green rim, buttery texture.

'Galil' is not aimed for export but for immediate consumption in the local market.

'Galil' is the earliest maturing summer cultivar, harvested from Aug to Sep.

(Before 'Ettinger', a season of great demand for avocado in Israel).

Green- skin new cultivar

'Moti'

'Moti' excels in productivity but tends to alternate bearing.

Fruit is relatively large, weighting between (averaging 380 g) .

The peel is smooth, glossy, relatively thick.

The flesh is yellow with green stripe at the margins, has buttery texture.

Harvest season is late - from January to April.

Harvesting season

	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
GALIL	→	→										
ETTINGER			→	→	→							
FUERTE			→	→	→	→	→	→	→			
HASS					→	→	→	→	→	→	→	
REED	→								→	→	→	→
PINKERTON					→	→	→	→				
LAVI						→	→	→				
NAOR					→	→	→	→				
MOTI						→	→	→	→			

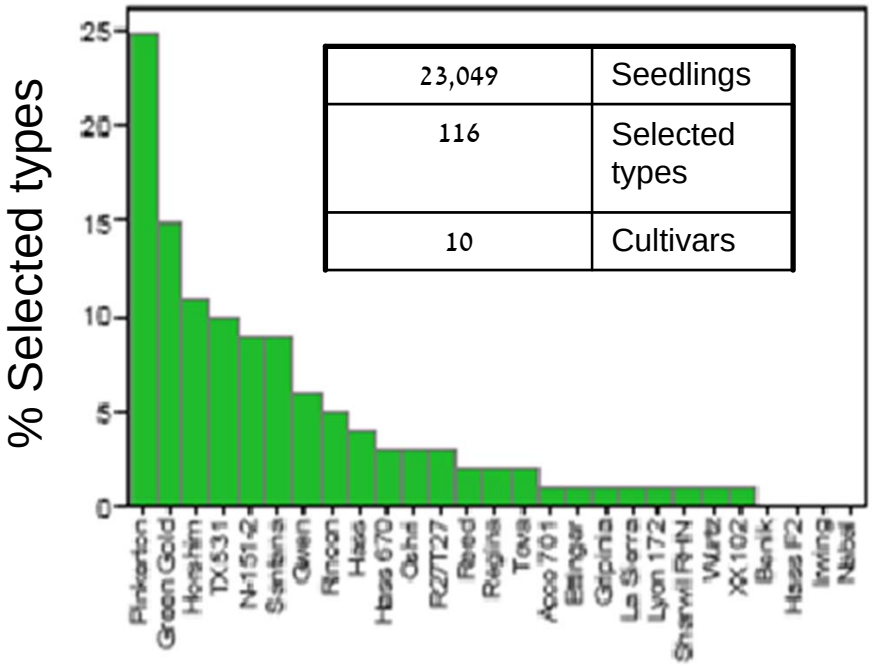
Renewed Avocado breeding program (2008…)

Stages in the current project

A- Seed collection:

1-From interesting cultivars 'mother –trees' (open pollination).

2-From caged trees (self/cross pollination)



23,049	Seedlings
116	Selected types
10	Cultivars

Data analysis from previous breeding program

Akko station April 2010

B- Seed germination and grafting.

Bet Dagan nursery 2009

C- Transfer to 'Seedling -plots', examination after first fruit appearance.

Fruit characteristics – color, size, seed size, postharvest quality
yield, flowering, stress tolerance

Bet Dagan Seeding plot Nov 2010

E- Transfer of the selected types (0.5% out 20,000) to 'Examination plots' Performance tracking.

So far .. 7,230 seedlings

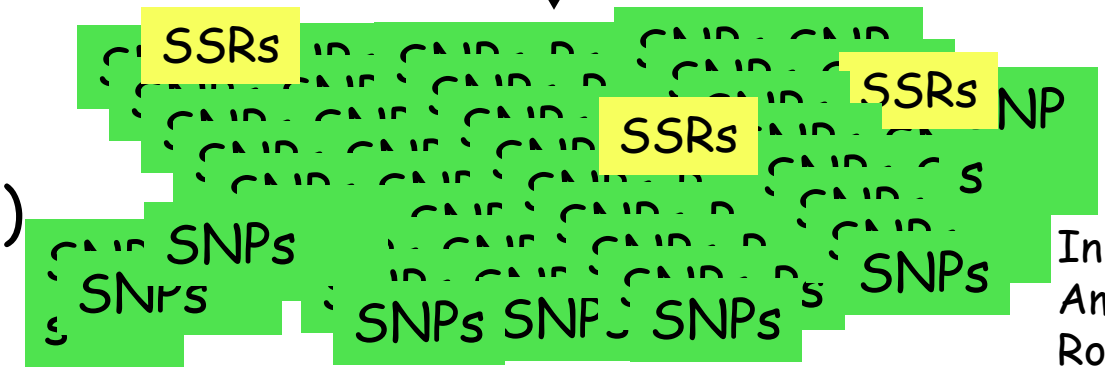
Integration of classical breeding and advance genomic technologies – Avocado project

Haas

Ettinger

High throughput sequencing
Bioinformatics

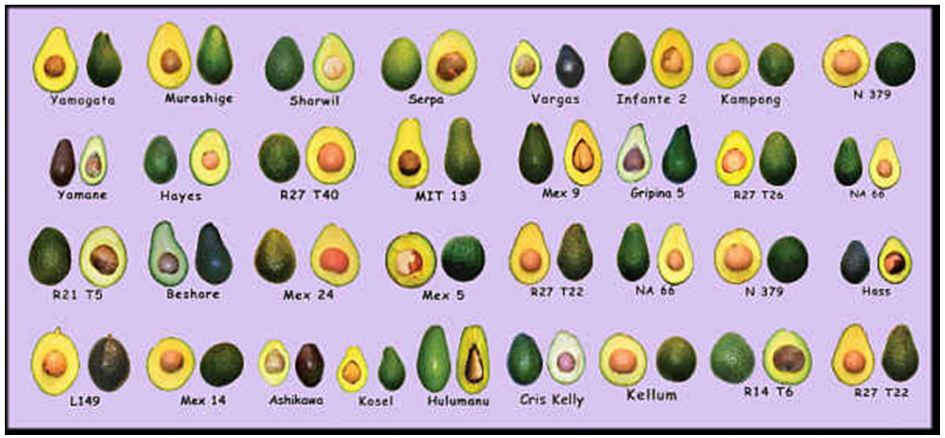
Genetic variation (mainly SNPs)



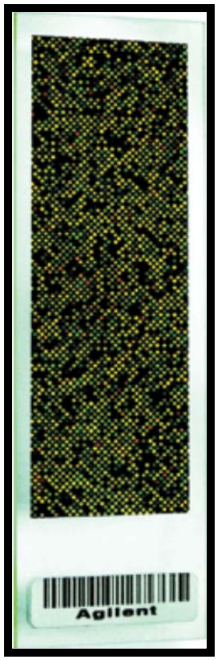
In collaboration with:
Amir Sherman
Ron Ophir

Integration of classical breeding and advance genomic technologies – Trait mapping using germplasm

Self design SNP array



Phenotpic variation germplasm/populations



AGILENT services
15,000-20,000 SNPs

Mapping Agricultural important traits

In collaboration with:
Amir Sherman
Ron Ophir

Integration of classical breeding and advance genomic technologies – Avocado project

Genetic engineering like transformation or siRNA etc, if the genes and the biological process is known

Basic research studies:

Molecular mechanisms controlling avocado 'Hass' fruit size - Implications for Crop Yield Enhancement.

SF NF

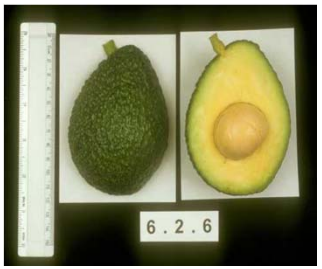
105 DAFB
(Days after full bloom)

Breeding of new avocado cultivars

Vered Irihimovitch	Volcani Center ARO
Emi Lahav	Acco Regional Experiment. Station, Israel
Gad Ish-Am	Acco Regional Experiment. Station, Israel
Doron Shnider	Acco Regional Experiment. Station, Israel
Moshe Goren	Volcani Center ARO
Itzhak Regev	Acco Regional Experiment. Station, Israel
Ezra Ideman	Acco Regional Experiment. Station, Israel
Micky Noy	Extension service, Israel, Ministry of Agriculture
Adolfo Levin	Acco Regional Experiment. Station, Israel
Edna Pesis	Volcani Center ARO
Oleg Finberg	Volcani Center ARO

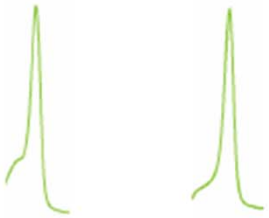
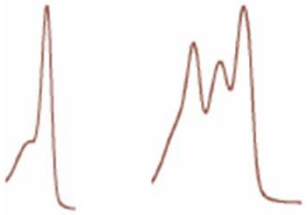
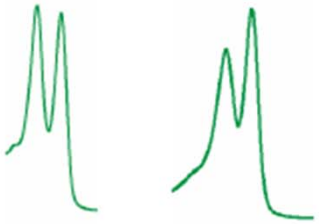
Bioinformatics

Amir Sherman	Volcani Center ARO
Ron Ophir	Volcani Center ARO



Supported by grant numbers: 203-0757 203-0795 The Chief Scientist of the Ministry of Agriculture, Israel.

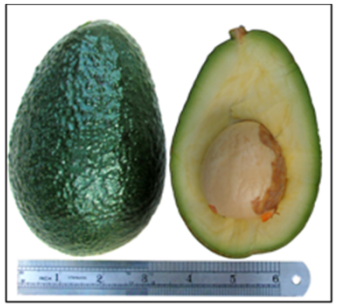
SNPs information can be also used for progeny genotyping

מס' צאצאים / האס' מכל סוג	סוג כרומטוגרמה מ-dHPLC: SNP1305	SNP1371+SNP1447		SNP1305	SNP1371	SNP1447		
8 (17%)			Hass or Ettinger	C C	C C	C C	♀ ♂	H H
20 (43%)			Ettinger	C C	C T	C T	♀ ♂	H E
19 (40%)			Ettinger or Irit	C T	C C	C T	♀ ♂	H I

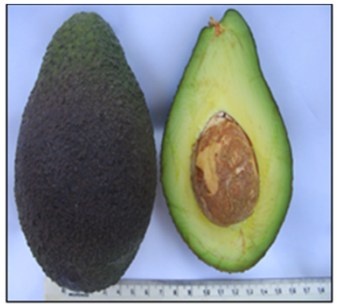
47 Total

In collaboration with:
Doron Schinder

'מוטי'



'בר'



'נאור'

זני אבוקדו חדשים (תוצרי תוכנית השבחה קודמת שהוגדרו לאחרונה כזנים חדשים)