Cold Conditioning in Strawberry Primer

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Introduction

- What is dormancy and how is it related to cold conditioning?
- What is dormancy-breaking and what does it mean in California strawberry?
- What have been the approaches been for cold conditioning in the past?

Dormancy

- State of suspended growth and metabolism.
- A dormant plant is a safeguard against harsh environmental conditions such as extreme heat or cold.
- Consequences of a plant still vigorously growing and actively metabolizing and suddenly exposed to freezing temperatures are not favorable at all.









- Physiological changes take place in the plant as well, mostly a transfer of sugars produced by the leaves to be stored as starch in the trunk, stem and roots.

Causes of Dormancy

- A very important factor involved in dormancy is photoperiod, which is transmitted to the leaves which make inhibitory substance or hormone that is moved to the buds of the plant to shut it down.
- Another important factor involved in dormancy is cold hence our naming of it as “cold conditioning” or “chill”. Cold has been defined as temperatures below 45 ° F, and for our understanding today, above 32 ° F and below 45 ° F.

Breaking of dormancy

- Perception of signals which which bring about the cessation of dormancy and resumption of normal plant growth.
- What those signals are is very important, since if it were based only on time the plant could “reawaken” at still an inopportune time for regrowth.

California strawberry growing

- Cold conditioning in California strawberry is about managing dormancy and even more the dormancy breaking, which after all is shortening the normal autumn – winter cycle so as to take advantage of the better growing conditions in Central and Southern parts of the state.

Chill in strawberry in California consists of two parts:

1. Induction of dormancy in the field with the onset of colder temperatures and lower light
2. Storage of the harvested plant for a set period of time at temperatures a little over freezing.

The purpose of chill for strawberry

Victor Voth: starch reserves appeared to influence performance of winter plantings mostly in relation to:

- The plant’s ability to survive
- To grow vigorously right after planting

The challenge from the very beginning is how to achieve balance between vigor and fruiting.



Too much chill with plants which did not belong with the rest of the box.
“Beach balls”.

Excessive runnering is also part of the vigor picture.

Too little chill



Management of plant vigor chilling in the past

- So what do we know about how chill has been managed in the past and the cold conditioning recommended to endow them with favorable vigor and production capacity once planted in the production field?

The performance evaluations are summarized in Table 1, and the key conclusions can be stated as follows. First, better performance was obtained for plants given 2-4 weeks supplemental storage regardless of their digging date. The benefit of supplemental storage was greater for plants harvested early, but substantial in both cases. Second, plants harvested early and given 4 weeks storage performed better than plants harvested late and established on the same date with 1 week supplemental storage. Apparently the time spent in the nursery does not compensate directly for time spent in the cold box. Third, total yield for Selva plants given adequate chilling (early harvest + 4 weeks or late harvest +2 weeks) was similar regardless of planting date, but the pattern of production pattern differed substantially (Figure 1). Yields were somewhat reduced in Seascape plants with later harvest and planting, as this treatment reduced early yield with no apparent benefit to late yield (Figure 2).

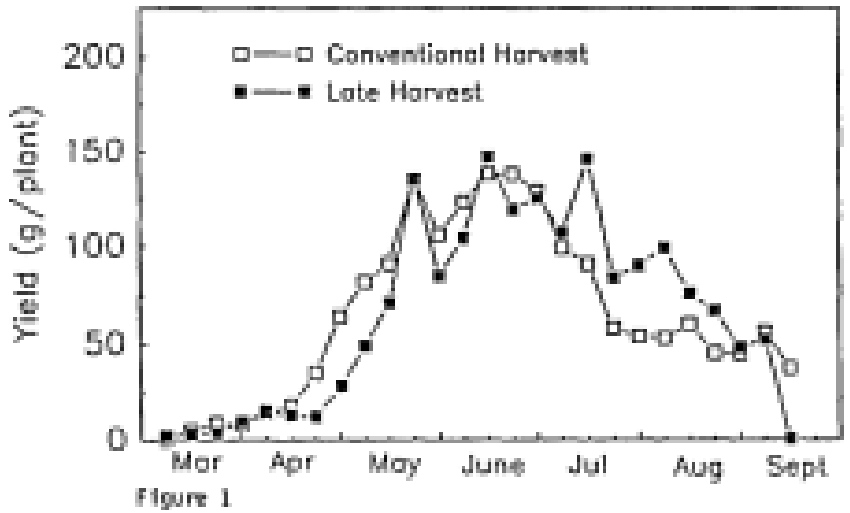


Figure 1

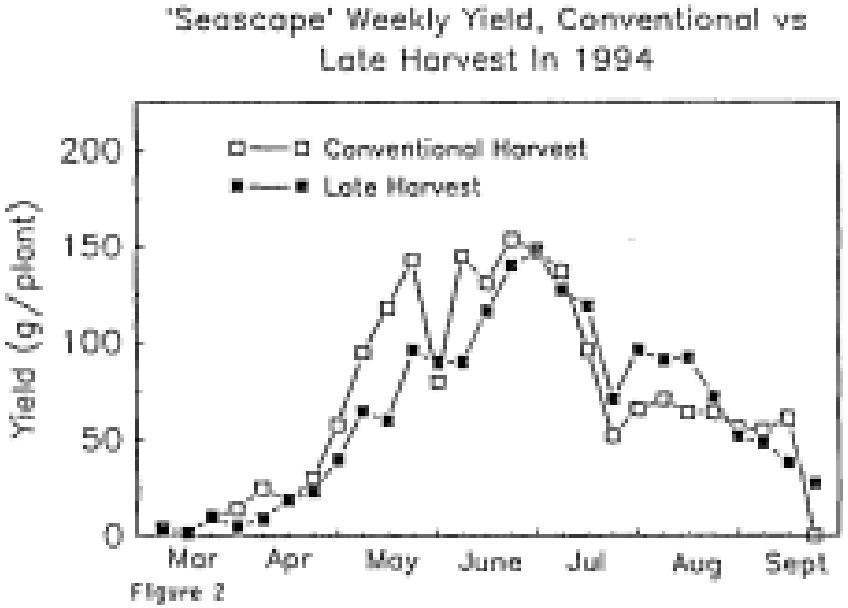


Figure 2

Conventional – Oct 17 (688 hrs < 45 F)
Late – Nov 9 – (1100 hrs < 45 F)

Better to dig early (Oct 17) and store longer(4 weeks) than to dig late (Nov 9) and store less (2 weeks)

= time spent in the nursery does not compensate directly for time in supplemental chill.

A few examples – recommended chill amounts for day neutrals were much higher than now

- Selva (day-neutral) – maximal hours of in field chill below 45 degrees F, and two to four weeks supplemental storage.

- Seascape (day neutral) – maximal hours of in field chill below 45 degrees F, and two to four weeks supplemental storage.

Do we even have those temperatures in the nurseries anymore?

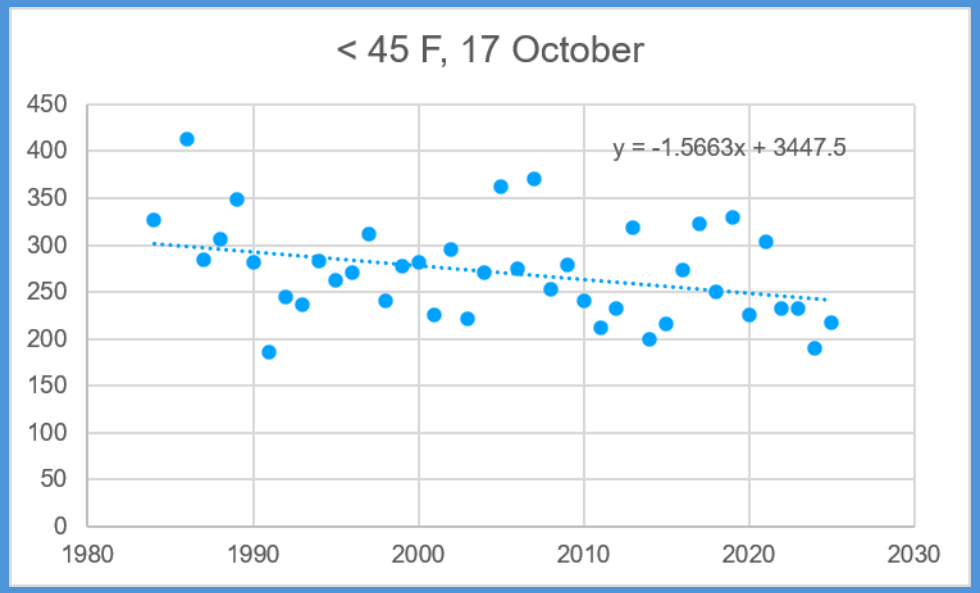
Chill accumulations in MacDoel - 32º F - 45º F

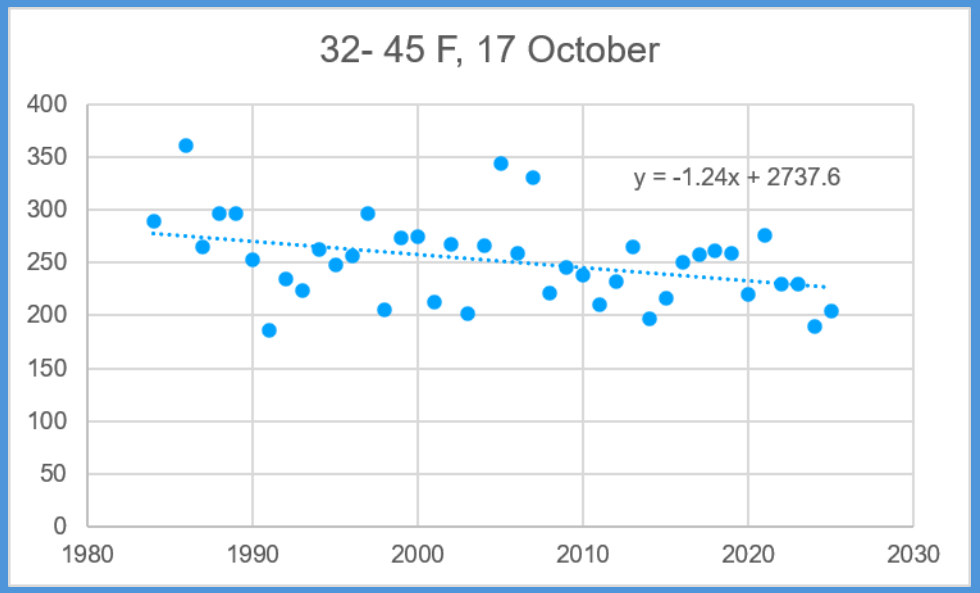
Harvest Year	October 17	November 9
2015	326	542
2016	374	576
2017	292	429
2018	332	419
2019	339	456
2020	278	432
2021	332	614
2022	232	401
2023	352	440
2024	328	512
2025	284	442
AVERAGE	**314±38**	**478 ± 68**

Chill accumulations in MacDoel - < 45º F

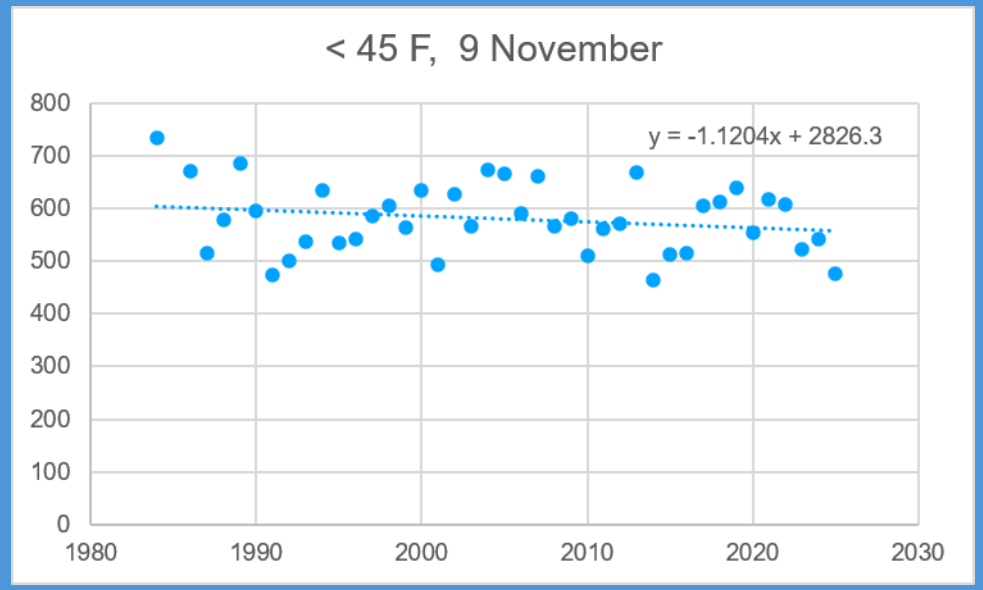
Harvest Year	October 17	November 9
2015	388	719
2016	469	754
2017	441	800
2018	448	779
2019	487	739
2020	335	705
2021	433	775
2022	409	814
2023	382	718
2024	362	758
2025	377	681
AVERAGE	**412 ± 45**	**749 ± 39**

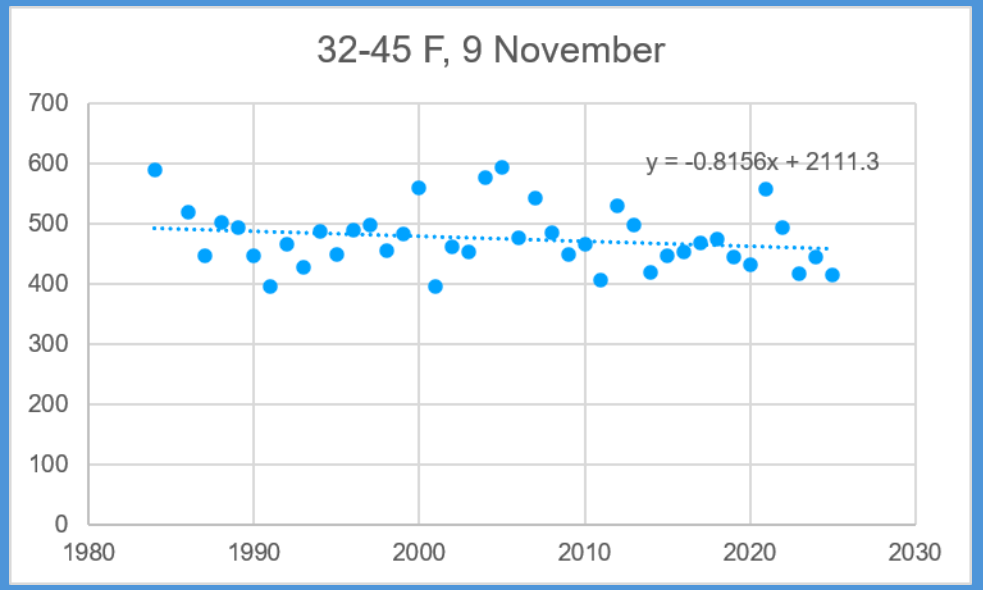
MacArthur – chill accumulations 1984-2025





MacArthur – chill accumulations 1984-2025





Advent of post year 2000 varieties pointed to a lower chilling requirement

- Albion
- Cabrillo
- Monterey
- San Andreas - was even planted in Southern California

Questions to be answered:

- Do we need similar amounts, in length of time and in particular temperature, of in-field chill as before?

- To figure out why time in the nursery doesn’t compensate for time in the cold box, what is the actual physiological process strawberry plants undergo during dormancy and dormancy breaking, in other words what they go through during the harvest and post-harvest cycle?