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The usage of POTASSIUM NITRATE for non-nutritional purposes

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8th of September 2010
Current Usages of Potassium Nitrate by Application

- Fertigation - nutrigation

**Primitive**

**Quantitative**

**Proportional**
Current Usages of Potassium Nitrate by Application

- Foliar feeding
Other horticultural techniques that may be further developed:

- Flowering-induction.
- Dormancy-breaking.
- Pest management.
- Seed Priming.
1. Flowering Induction
Flowering Induction with Potassium Nitrate in Mango in Puerto Rico

• Potassium nitrate application.
Flowering Induction with Potassium Nitrate in Mango in Puerto Rico

• Full bloom on same trees, 4 weeks after potassium nitrate application.
Flowering Induction with Potassium Nitrate in Mango in the Philippines

• Purpose: defining optimal treatment for increasing mango yield and quality.

• Experimental set-up:
  – 21 years old trees cv. “Carabao”, were fed and irrigated according to the commercial routine.
  – Treatments were spraying Haifa’s Multi-npK (12-2-44) at various concentrations.
  – Sprays were checked between Feb. 27 and July 1, 1995.
Flowering Induction with Potassium Nitrate in Mango in the Philippines

- Treatments consisted of one application of:
  1. Control (water).
  2. Multi-npK 1.0%.
  3. Multi-npK 1.5%.
  4. Multi-npK 2.0%.
  5. Multi-npK 2.5%.
  6. Multi-npK 3.0%.
  7. Boom - a local commercial product.
  8. Super blum - a local commercial product.

- 4 replicate trees per treatment.
Flowering Induction with Potassium Nitrate in Mango in the Philippines

- Haifa’s potassium nitrate “Multi npK” (12-2-44).

Flowering Induction with Potassium Nitrate in Mango in the Philippines

• Conclusions:
  – Haifa’s “Multi-npK” is recommended as flower inducer for ‘Carabao’ vs. standard chemicals due to:
    1. High flowering rate at 14 & 21 days after induction.
    3. Higher fruit-setting.
  – Recommended dose rate per season:
    • December-April season: 1.0% and 1.5%.
    • July-November season: 2.0% and 2.5%.
Flowering Induction in Mango by Various Nitrate Salts

- Spraying potassium nitrate resulted in statistically significantly greater % flowering in mango, compared to other nitrate salts.

Flowering Induction in Mango

Common worldwide mango cultivars

Source unknown
The exact mechanism of foliar applied potassium nitrate in mango on bud dormancy break is still not fully understood.

Mango shoots must have low gibberellic acid (GA) content to allow total non-structural carbohydrates, primarily starch, to accumulate in the leaves and buds, leading to the early formation of floral initials (Protacio et al, 2009).

Floral initials were present before potassium nitrate application, indicating that this chemical merely induces bud break of quiescent pre-existing floral buds and is not responsible for the transformation of vegetative buds to reproductive ones (Protacio et al, 2009).

Flowering Induction with Potassium Nitrate in Mango – Mode of Action

• It is generally accepted that nitrate salt application stimulates bud break. Presumably, there is a threshold for nitrogen concentration that if exceeded, will allow the plant to flower (Protacio, 2000).

• Potassium nitrate probably acts by elevating nitrogen levels over a nitrogen threshold thereby synchronizing budbreak from apices with existing floral initials. The signaling process is probably mediated by polyamines or ethylene (Protacio, 2000).

• In addition, the role of potassium nitrate is related to increased production and translocation of sugars to the bud.

• General recommendation: 3 to 4 weekly sprays with potassium nitrate (3-4% w/v) to affect general terminal bud development, and to ensure intense and even flowering.

Flowering Induction with Potassium Nitrate in Litchi in India

• Main problems in litchi (*Litchi chinensis*) are:
  – Yields are often irregular and suffer from alternate bearing.
  – Productivity in off-years is unacceptably low.
• The experiment:
  – 12 years old trees cv. “Bombai”, were fed and irrigated according to the commercial routine.
• Treatments applied by 4 sprayings at 30-days intervals, Sept.-Dec.:
  1. Control
  2. Ethephon 0.4 ml/L
  3. Potassium nitrate 1%
  4. TIBA (tri-iodobenzoic acid) 0.1%.
• Eight replicate trees per treatment.
Flowering Induction with Potassium Nitrate in Litchi in India

% Flowering shoots in litchi trees in “Off”-years

- Control
- Ethephon
- Pot. Nit.
- TIBA

Flowering shoots (%)

1996 1998 4-years mean

Mitra & Sanyal, West Bengal, India. 2001.
Flowering Induction with Potassium Nitrate in Litchi in India

Yield of litchi trees in “Off”-years

Mitra & Sanyal, West Bengal, India. 2001.
Flowering Induction with Potassium Nitrate in Litchi in India

• Conclusions:
  1. Potassium nitrate could replace the need for vegetative dormancy period, and induced higher flowering rates than plant growth regulators.
  2. The higher flowering resulted in higher yields, mainly in “off” years and thus produced highest yields also on 4-years basis.
2. Dormancy Breaking in Plants
Natural Dormancy Breaking in Plants

• The transition of both vegetative and floral buds of temperate or semi-deciduous subtropical fruits species from the dormant to active state requires:
  – chilling in temperate fruit species.
  – alleviation of drought (“wet” season following the “dry” season) in semi-deciduous subtropical fruits (e.g. custard apple, guava, persimmon).

• In temperate fruit, main signs of lack of chilling are: sporadic flowering, flowers only on terminal sections, rosette formation, and uneven shoot development along branches (George et al, 2002).

• In strawberry, chilling time requirement to break dormancy depends on cultivars and can be classified as weak, medium or strongly dormant groups (Maroto et al, 1997).

Chemical Dormancy Breaking in Plants

- Important Rosaceous, and semi-deciduous subtropical species can benefit from chemical dormancy breaking.

- Dormancy-breaking chemicals can be used for three purposes:
  1. Allowing sensitive cultivars to be grown under insufficient chilling, e.g. due to global warming.
  2. Capture early-season markets.
  3. Breaking apical dominance, thereby increasing flowering and yield.

- Some old chemicals were found to be phytotoxic and/or hazardous to people (e.g. DNOC, hydrogen cyanamide).

Dormancy Breaking in Nectarine (cv. Weinberger) in Turkey

- When sprayed together, Thio-urea 1% and potassium nitrate 2% resulted in statistically significantly greater yield than the control treatment or Thio-urea 1% alone, and 2 days earlier ripening and harvest.

Dormancy Breaking in Custard Apple in Subtropical Australia
(Annona squamosa cv Hiliary White)

• When sprayed together, Waiken (emulsified vegetable oil) 3% and potassium nitrate 5% resulted in statistically significantly greater number of laterals and flowers per meter main branch length than the control treatment or Waiken 3% alone on current season wood.

Dormancy Breaking in Custard Apple in Subtropical Australia
(Annona squamosa cv Hiliary White)

• Conclusion:
  – Potassium nitrate has a synergistic effect with other dormancy-breaking substances, improving branching, flowering, fruit-set and early fruit maturation.

Dormancy Breaking in Temperate and Subtropical Tree Crops

• George et al (2002) conducted several experiments in southeast Queensland, Australia, to determine whether combinations of new rest-breaking chemicals could induce more uniform budbreak and increase flowering of a range of low-chill temperate and subtropical species (low-chill stonefruit, i.e. nectarine cv Springbite, persimmon and custard apple).

• The most successful rest-breaking chemicals were Armobreak (alkolated amine) and Waiken (mix of fatty acid esters), but only when combined with potassium nitrate, which greatly improved their efficacy by 20-30%.

• North (1992) reported similar findings in South Africa in apple when potassium nitrate was added to Armobreak.

• Potassium nitrate alone has a mild rest-breaking ability (George et al, 2002).

Dormancy Breaking in Grape Vines (Cv Superior) in Israel

- Early spring sprays of dormancy-breaking agents are employed to markedly improve yields and precocity of table grapes.
- Potassium nitrate can successfully reduce the usage of phytotoxic and cancerous Dormex (calcium cyanamide).

<table>
<thead>
<tr>
<th></th>
<th>Unsprayed</th>
<th>Commercial Dormex (5%)</th>
<th>Dormex 2%</th>
<th>Dormex 2% + Pot. Nit. 6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bud burst (%) 30 days after spraying</td>
<td>1</td>
<td>41</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Yield of first harvest</td>
<td>63%</td>
<td>100%</td>
<td>88%</td>
<td>127%</td>
</tr>
<tr>
<td></td>
<td>16.4 ton/ha</td>
<td>26 ton/ha</td>
<td>22 ton/ha</td>
<td>33.0 ton/ha</td>
</tr>
</tbody>
</table>

Sofer & Shnek, Haifa Chemical, Israel. 1996.
Potassium nitrate can successfully reduce the usage of phytotoxic and cancerous Dormex (calcium cyanamide).
Dormancy Breaking in Strawberry in Spain

• Fresh runners of strawberry var. Chandler from a low elevation nursery (Universidad Politécnica de Valencia, Spain) were used.

• Transplanting on 10 December in containers with peat and sand (1:1 volume).

• On 14 January, the following treatments were spray-applied directly to the crown:
  – Control, untreated plants.
  – Potassium nitrate 3.0%
  – HC (hydrogen cyanamide) 0.5%

• On 21 January, plants were placed in a large tunnel, 8 m wide, 0.2 mm thick polyethylene.

• Randomized blocks with 3 replicates of 10 plants.

Dormancy Breaking in Strawberry in Spain

• Results
  – Potassium nitrate gave earlier yields (P=0.05), but total yields were similar.
  – Average fruit weight of plants treated with potassium nitrate and HC were higher than control plants at the end of the season, but no significant differences were detected for early production.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Commercial production (g/plant)</th>
<th>Average fruit weight (g/fruit)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>31 Mar</td>
<td>31 May</td>
</tr>
<tr>
<td>Control</td>
<td>36.4 b</td>
<td>138.5</td>
</tr>
<tr>
<td>Potassium nitrate</td>
<td>56.7 a</td>
<td>140.1</td>
</tr>
<tr>
<td>HC</td>
<td>38.1 b</td>
<td>127.1</td>
</tr>
</tbody>
</table>

The potassium ion (as in potassium nitrate) plays an important role in carbohydrate synthesis and translocation from the leaves to the buds.

A build up of carbohydrates in the buds improves floral initiation. (Scholefield et al. 1985, Menzel et al. 1989).


Yan Diczbalis and Dr. James Drinnan. 2007. Floral manipulation and canopy management in Longan and Rambutan http://www.google.be/search?hl=nl&q=potassium+nitrate+bud+dormancy+break&start=120&sa=N
3. Pest Control
Pest Control

- Aphids
- Scales
- Nematodes
Pest Control – Insects

Pecan Yellow Aphid (*Monellia caryella* Fitch)

Healthy

Infected

Sooty layer
Pest Control – Insects
Pecan Yellow Aphid (*Monellia caryella*. Fitch)

- Treatments:
  1. Unsprayed control
  2. Surfactant only (0.15% w/w)
  3. Pot.nit (1.0% w/w)
  4. Pot.nit (1.0% w/w) + surfactant (0.15% w/w).

- 85-years old ‘Moneymaker’ Pecan orchard in Georgia, USA.
Pest Control – Insects

Pecan Yellow Aphid (*Monellia caryella*. Fitch)

- Juvenile aphids count, 1 day after spraying.

Pest Control – Insects
Pecan Yellow Aphid (*Monellia caryella*. Fitch)

![Graph showing number of aphids per leaf over time with sprays at 2-week intervals.]

Sprays were done at 2-weeks intervals.

Pest Control – Insects
Florida Wax Scale (*Ceroplastes floridensis*)

- Florida Wax Scale is an important citrus pest.

Sooty layer on an infected leaf

Adults

Young crawlers
Pest Control – Insects

Florida Wax Scale (*Ceroplastes floridensis*)

- **Purpose:** Test the control of FWS by potassium nitrate in comparison with broad-spectrum insecticides.

- **Location:** A 34 ha, 20 years old, citrus grove, Valencia x sour-orange, in the southern coastal plain of Israel.

- **Treatments:**
  1. Organophosphate, 13 liters sprayed in 3,500 L water/ha.
  2. Summer oil, 3%, sprayed in 3,500 L/ha.
  3. Potassium nitrate (Pot.nit) 4% + surfactant (Triton B-1956) 0.05%, sprayed in 3,500 L/ha.
  4. Untreated control.
Florida Wax Scale (*Ceroplastes floridensis*)

- **Treatments:**
  - Larvae counts were performed on June 1st.
  - Sprays were done 2 days later.
  - Adult females were counted 75 and 241 days thereafter.
Pest Control – Insects
Florida Wax Scale (*Ceroplastes floridensis*)

- Control of FWS by potassium nitrate + medium oil was as good as org. phos. pesticides, and stat. sign. better than untreated control.
Pest Control – Insects
Florida Wax Scale (*Ceroplastes floridensis*)

  - prior to adoption of larvae-thinning strategy.
  - Out of a 34 ha plot.

<table>
<thead>
<tr>
<th>Annual mean of area treated with</th>
<th>Annual mean of area treated with</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organophosphate pesticides</td>
<td>Medium oil</td>
</tr>
<tr>
<td>23 (ha)</td>
<td>2 (ha)</td>
</tr>
</tbody>
</table>
Pest Control – Insects
Florida Wax Scale (*Ceroplastes floridensis*)

- Control of FWS by broad-spectrum insecticides in 1987-1993.
  - After adoption of larvae-thinning strategy.
  - Out of a 34 ha plot.

<table>
<thead>
<tr>
<th>Annual mean of area treated with</th>
<th>Annual mean of area treated with</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organophosphate pesticides</td>
<td>4%Pot. Nit &amp; 2% medium oil</td>
</tr>
<tr>
<td>0.6 (ha)</td>
<td>28 (ha)</td>
</tr>
</tbody>
</table>
Pear *Psylla* (*Psylla pyri* and *Psylla pyricola*)

- Pear *Psylla* are considered to be major threats in pear growing:
  1. Adults and larvae suck saps from flower buds. Consequently, the flower buds do not open at all or only partially, which results in a reduced pear yield.
  2. When larvae penetrate fruits, the fruit gets damaged (scorching), which results in significant fruit quality loss.
  3. The plant cells, on which the eggs were positioned, die. Affected leaves, shoots and young fruits, become distorted and malformed. Affected fruits suffer from a significant quality loss.
  4. …
4. Furthermore, marked damage is caused by black sooty mold fungi, which settle on the honey dew, excreted by the larvae.

- From the beginning of July onwards (in the Netherlands) fruits and leaves become black-stained. Fruit quality is reduced.
- Additionally, leaves covered with sooty mold suffer from reduced photosynthesis, which results in smaller fruits.

Pear psylla on Bartlett - adult and hardshell stages
Pest Control – Insects

Pear *Psylla* (*Psylla pyri* and *Psylla pyricola*)

- Pear *psylla* damage to pear fruit.

http://www.agf.gov.bc.ca/cropprot/tfipm/pearpsylla.htm
Pest Control – Insects

Pear *Psylla* (*Psylla pyri* and *Psylla pyricola*)

• **Trial set-up**
  – In 2003, six Dutch pear growers tested a total of four fungicides and fertilizers for their effect against *Psylla* larvae.

• **Results**
  – Potassium nitrate and a spreader surfactant outranked Euparene fungicide (N1,N1-dimethyl-N-phenyl-fluorine-dichlormethylthiosulfamide; Bayer Crop Science) and magnesium sulphate.
  – Young larvae (stages L1 and L2) were most susceptible to fungicides and fertilizers.
Pest Control – Insects

Pear *Psylla* (*Psylla pyri* and *Psylla pyricola*)

• Mode of action of potassium nitrate on *Psylla pyri*
  – The effect of potassium nitrate on *Psylla pyri* is not a direct insecticidal effect, but has a more indirect effect on its larvae.
  – Young larvae are covered and protected by an exudate layer, which consists of a liquid, sticky solution of mainly concentrated sugars.
  – Potassium nitrate is a hygroscopic salt. As such, potassium nitrate attracts the exudate layer that surrounds young larvae. The larvae loose their natural protection (i.e. the exudate layer) against desiccation, and become more vulnerable to natural enemies and crop protection means.

Pers comm. Ir T. Deckers-PCF Belgium
Pest Control – Insects

Pear *Psylla* (*Psylla pyri* and *Psylla pyricola*)

- IPM recommendations employing potassium nitrate
  - A recommended strategy consists of a foliar application of potassium nitrate at 5-7 kg/ha, followed one week later, by an insecticide application.
  - Insecticides will act more efficiently, when the protective exudate layer has been taken away from the larvae.
  - Furthermore, potassium nitrate contains N and K, which are very useful for fruit size and flower bud formation in pear.

Pers comm. Ir T. Deckers-PCF Belgium
• Root-knot nematode (*Meloidogyne incognita*) in a tomato seedling.
Pest Control – Nematodes

- Root-knot nematode (*Meloidogyne incognita*) in a tomato seedling.
Pest Control – Nematodes

- Tomato seedlings after 21 days of incubation with *M. incognita*.

  Untreated | Treated with KNO$_3$, 30 mg/L ($3 \times 10^{-4}$ M)

  Increased plant length

  Increased root growth, without root knot formation
Pest Control – Nematodes

• Potassium nitrate was found to produce a negative chemotaxis for 2nd-stage juveniles of *Meloidogyne incognita*.
• Potassium nitrate creates a chemical “shield” around the root system.

<table>
<thead>
<tr>
<th></th>
<th>Pot. Nit.</th>
<th>KCl</th>
</tr>
</thead>
<tbody>
<tr>
<td>% protection* ± S.D.</td>
<td>79.1 ± 6.7</td>
<td>12.3 ± 9.8</td>
</tr>
</tbody>
</table>

* By comparing number of eggs produced in treated vs. untreated plants

• Conclusion: Minimum effective dose was 20 mg / plant.
Pest Control – Fungi

- Objective: to study the effects of potassium nitrate (KNO$_3$) application under laboratory conditions on:
  1. Phytophthora stem rot disease reduction of *Glycine max* (L.) Merr. cvs. Chusei-Hikarikuro and Sachiyutaka,
  2. mycelium growth
  3. zoospore release of a *Phytophthora sojae* isolate, and
  4. to determine the distribution and accumulation of potassium using Scanning Electron Microscope (SEM) observation in soybean seedlings.

1. Effect of potassium nitrate application on disease reduction.

• Trial set-up:
  – Seeds of each cv were placed on autoclaved 0.7% water agar medium, containing various concentrations of potassium nitrate.
  – When the first primary leaf appeared, about 10 d after sowing, the stem of the soybean (with a 1 mm wound) near ground level was covered with mycelium of *P. sojae* isolate.
  – The number of dead and surviving plants in each bottle was recorded 16 days after inoculation.
  – The disease incidence was calculated as the ratio of infected plants to the initial eight seedlings in each bottle.
  – Three replicates with two test bottles.
Pest Control – Fungi

- Result: The application of 4–30 mM potassium nitrate (0.4-3 kg KNO₃/1000 L) prior to disease inoculation greatly reduced incidence of Phytophthora stem rot disease in the two soybean cultivars.

2. Effect of potassium nitrate application on mycelium growth.
   - A concentration of 20–30 mM potassium nitrate led to a slight decrease in the mycelium growth rate of the PJ-H30 isolate on PDA medium.
2. Effect of potassium nitrate application on mycelium growth.
   – The results might be due to multiple effects of direct suppression on mycelium growth in combination with the response of the host plant tissue to potassium nitrate.
3. Effect of potassium nitrate application on zoospore release.
   - All levels of potassium nitrate (0.4-30 mM) significantly (P< 0.05) reduced the release of zoospores.


- Results indicate that increased potassium concentrations in plants were associated with disease reduction in both cultivars.

• Results
  – Scanning electron microscopic observation with fresh samples indicated marked accumulation of potassium at the penetration-stopping sites of *P. sojae* in the cortex layer of soybean plants treated with 30 mM potassium nitrate, compared with the non-treated control plants.
  
  – In this study, marked accumulation of other inorganic elements such as S, Mg, Ca and P, was not observed at the penetration sites of *P. sojae*. 

• Conclusions
  – Potassium nitrate greatly influenced disease reduction of Phytophthora stem rot in soybean under lab conditions.
  – This effect could be mediated by:
    • a response of the host tissue to increased potassium directly,
    • and possibly by a direct inhibition of mycelium growth (at high levels of K),
    • and by increased nitrogen in plants (for greater protein synthesis and increased expression of disease resistance genes).
  – The application of 20-30 mM potassium nitrate may be effective for disease management of Phytophthora stem rot through the inhibition of the release of zoospores.

General conclusion:

- These results suggest the possibility of applying a solution containing 20–30 mM of potassium nitrate (2-3 kg KNO$_3$/1000 L) to decrease the incidence of disease in agricultural fields by the response of plant tissues to potassium nitrate.
Pest Control – Pot. Nitrate Increases Plant Resistance towards Diseases

• Potassium nitrate increases the resistance of the plant towards diseases.
  – The potassium in potassium nitrate eliminates the accumulation of short-chained carbohydrates and non-protein nitrogen, which may serve as substrates for invading bacteria, fungi, nematodes and viruses (www.kno3.org).
  – Good potassium fertility is associated with strong cell walls that enhance disease resistance and the ability of the crop to maintain firm tissues (Marschner, 1995).
  – Foliar application of potassium salts, including potassium nitrate, to the first true leaf of cucumber, before inoculation with powdery mildew, induced systemic protection from the disease organism (Reuveni et al, 1995).
Pest Control – Increased Plant Resistance towards Diseases

• Potassium probably exerts its greatest effects on disease through specific metabolic functions that alter compatibility relationships of the host-parasite environment.
  – Potassium in plant increases the production of disease inhibitory compounds, such as phenols, phytoalexins and auxins around infection sites of resistant plants.
  – Under low plant K conditions, inorganic N accumulates and phenols, that have fungicidal properties, are rapidly broken down (Kiraly, 1976).
  – In addition, K deficiency leads to thinner walls and slower growth of meristematic tissue, making easier for the parasites to penetrate the epidermis (Bergmann, 1992).

Seed Priming with Potassium Nitrate
• Purpose of the trial:
  – to evaluate, under commercial agronomy in farmer’s fields, the effect of seed priming on the emergence, growth, development and harvestable yield of processing tomatoes.

• Trial set-up:
  – Processing tomato seeds (UC 82 B) were primed in 10 litre priming columns in a solution of potassium nitrate (KNO$_3$) and dipotassium phosphate (K$_2$HPO$_4$) (-1.25 MPa) for 12 days at 15°C, then air-dried.
  – Seeds were sown in a farmer’s field in Darlington Point, Australia.
  – An early season and a mid season sowing were made in each of two growing seasons.
Processing Tomato Seed Priming with Potassium Nitrate

• Results:
  – Processing tomato seed priming reduced growing degree days of air temperature above 10°C, required for 80% emergence, by about 35% from each sowing.

| Treatment       | Sowing date |          |          |          |          |
|-----------------|-------------|----------|----------|----------|
|                 |             | 1983     | 1985     |          |          |
|                 | Oct. 12     | Oct. 21  | Oct. 3   | Oct. 15  |
| Growing Degree Days to 80% emergence |            |          |          |          |
| Primed          | 37          | 45       | 45       | 35       |
| Unprimed        | 57          | 67       | 70       | 55       |
| % Reduction due to priming | 35          | 33       | 36       | 36       |

Processing Tomato Seed Priming with Potassium Nitrate

• Results:
  – Or, in practical terms, primed seedlings emerged:
    • 4 to 5 days earlier from cold soils, typical of spring sowings.
    • 1 to 2 days earlier from warmer soils, typical of mid season sowings.
  – On average there were 5 to 10% more ripe fruit in the early sown primed crops at all harvests, except maturity.
  – The 1 to 2 day difference in emergence of the late sown crops was either lost or undetectable by maturity.
  – Priming had no effect on crop stand uniformity and size at harvest in processing tomato (marketable product is the reproductive organ), as found by others in carrot, onion and parsley (marketable product is the vegetative organ).
Processing Tomato Seed Priming with Potassium Nitrate

• Conclusions:
  – Seed priming can provide earlier emergence, development, flowering, and maturity for chilling-sensitive crops sown into cold soils, without any loss in final yield.
  – Seed priming may offer a convenient method of both shortening the time to establishment of early crops and providing greater flexibility in processing plant schedules.

Freshly Harvested Papaya Seed
Primming with Potassium Nitrate

- Objective:
  - To investigate and enhance seed germination in two commercially grown genotypes (“Solo” and “007”) of importance in Queensland, Australia, and the effects of potassium nitrate on breaking dormancy and improving germination of fresh seed pre-storage.

http://en.wikipedia.org/wiki/Carica_papaya

Freshly Harvested Papaya Seed
Priming with Potassium Nitrate

• Trial set-up:
  – Germination testing was undertaken by placing seeds on wet filter paper in Petri dishes in an environmental chamber at 25 ± 2°C in the dark.
  – Seeds were pre-soaked in aqueous solutions of potassium nitrate at a range of concentrations (0, 0.25, 0.5, 1.0 1.5 M) for 0, 15, 30, 60 min, 2, 3, 6, 14 or 24 h prior to germination testing.
  – Ten replicates of 25 seeds were used for each germination treatment and germination was recorded (days 7-14 post incubation) as the percentage of seeds showing radicle emergence.

Freshly Harvested Papaya Seed Priming with Potassium Nitrate

• Results:
  – Mean germination percentages of fresh seeds were very low (0 and 2.4% for “Solo” and “007” resp.), despite the high levels of seed viability determined by TTC testing.
  – The mean percentage of germination increased above control levels for both varieties after pre-treatment in either 0.25M or 0.5M potassium nitrate.

Freshly Harvested Papaya Seed Priming with Potassium Nitrate

- **Results:**
  - The highest mean percentage of germination was seen after pre-treatment at 0.25M potassium nitrate for 2 or 3 h (64 and 65.2% for “Solo”, 58 and 64% for “007”).

Each data point is the mean of 10 replicates of 25 seeds.
- Error bars are standard errors of the means (SEM).

Freshly Harvested Papaya Seed Priming with Potassium Nitrate

• Conclusion:
  – Dormancy in fresh seeds of papaya cultivars when freshly harvested, could be broken to give acceptable levels of germination when GA$_3$ (data not shown in this PPT) or potassium nitrate were used; potassium nitrate gave the highest levels of germination for “007” seeds and may be the preferred treatment for application in the industry.

Summary - The Usage of Potassium Nitrate for Non-Nutritional Purposes
Summary - The Usage of Potassium Nitrate for Non-Nutritional Purposes

- Potassium nitrate has very positive effects for:
  - Flowering induction (mango, litchi).
  - Dormancy breaking (nectarine, custard-apple, Rosaceae fruit trees, vineyard and strawberries).
  - Pest management – “green” and integrated (aphids, scales, pear Psylla, fungi, nematodes).
  - Seed priming.