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Kritiese Watertekorte Besproeiingsriglyne vir Sagtevrugtebome

Droogtes noodsaak dat elke druppel water so spaarsaam en doeltreffend as moontlik gebruik word. Die grootste waterbesparings kan vroeg en laat in die seisoen gemaak word.

Die beginsel is om water tydens die seldelingsfase, naamlik bot tot 40 dae na blom by kernvrugte of bot tot end pitverharding by steenvrugte, te spaar omdat die boom in hierdie ontwikkelingstadium nie baie sensitief vir watertekorte is nie en beheerde waterspanning nie vruggrootte noemenswaardig beïnvloed nie. Verder is dit ’n periode van die seisoen met ’n laer evapotranspirasie wat ’n laer waterbehoefte tot gevolg het.

Die tweede fase om water te spaar is na-oes by steen- sowel as kernvrugte. Dit is die tyd wat die boom sy reserwes aanvul. Navorsing in die Koue Bokkeveld oor watertekorte gedurende spesifieke fenologiese fases by Golden Delicious appels, het bevind dat ’n baie droë na-oes waterregime (90% onttrekking van plantbeskikbare water) min effek op vruggrootte sowel as produksie in die volgende seisoen gehad het. (Let wel dat 90% onttrekking uiterste toestande en nie ‘n teiken onttrekking is nie.)

Die periode waartydens die beskikbare water maksimaal benut moet word vir besproeiing, is tydens die selvergroting- en rypwordingsfase, basies 40 dae na blom tot en met oes.

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Belangrike bepalende faktore by besproeiing tydens watertekorte

- Hoeveel water is beskikbaar vir besproeiing?
    - Die hoeveelheid besproeiingswater beskikbaar gaan die intensiteit van waterbesparing bepaal.

- Fenologiese fase:
    - Water kan in die seldelings en na-oes fase gespaar word. Die tydperk wanneer selvergroting by kernvrugte en pitverharding by steenvrugte plaasvind moet op ’n boord basis bepaal word.

- Prioritiseer boorde
    - Hoogs winsgewende boorde se besproeiingstrategie gaan verskil van minder winsgewende boorde. Dit is die jaar om swak boorde te verwyder.

- Grondeienskappe
  Grondeienskappe het ’n groot invloed op die hoeveelheid en gereeldheid van besproeiing. Die onderstaande faktore kom dikwels in kombinasie voor en moet in geheel beskou word. Boorde wat op gronde voorkom wat nie goed gebuffer is teen watertekorte nie moet geïdentifiseer word en korrek bestuur word.

    - Waterhouvermoë van die grond
        - Gronde met ‘n hoër slik en klei-inhoud (swaarder gronde) kan later begin besproei word as sanderige gronde en met langer besproeiingintervalle gegewe dat die gronde versadig was met die aanvang van die seisoen.

        - Klipfraksie - Gronde met ‘n hoë klipfraksie sal vroeër begin en meer gereeld besproei word in vergelyking met gronde met ‘n lae klipfraksie of waar dit afwesig is.

    - Gronddiepte en worteldiepte
        - Volwasse boorde benut meeste van die grondvolume tot ‘n beperkende laag aangetref word. Die grootte van die benutte grondvolume het ‘n direkte invloed op die grootte van die resevoir waaruit die boom water onttrek en bepaal grootliks hoeveel water gegee moet word en hoe gereeld.

    - Jong boorde
        - Jong bome se wortelstelsel is baie klein en benut aanvanklik nie die volle grondvolume nie. Die resevoir waaruit die boompie water onttrek is daarom kleiner. Weereens beïnvloed dit die hoeveelheid en hoe gereeld water

gegee moet word.

- Topografie en hellings
    - Koeler suidelike hellings en laagliggende gebiede sal later begin besproei word.
    - Warm noordelike en westelike hellings sal meer gereeld besproei word weens hoër evapotranspirasie.
    - Identifiseer nat boorde of areas waar eers later besproei sal word.
    - Boorde in hoogliggende gebiede sal vinniger uitdroog. Weens ondergrond dreinering van water sal boorde in laagliggende gebiede dikwels minder gereeld besproei word.

Waterbesparende Praktyke

1. Skakel onkruidkompetisie uit
    - Spuit onkruide oor die benatte strook dood.
    - Spuit onkruid oor die volle oppervlakte dood.
    - Moenie meganiese bewerking toepas nie aangesien wortels naby die grondoppervlakte, wat dou en lae neerslae benut, daardeur vernietig word.

2. Verminder oppervlakverdamping
    - Bedek die grondoppervlak met 'n deklaag van growwe, dooie plantmateriaal (strooi,

gras, of verrotte saagsels). 'n Deklaag is beter as geen deklaag.

- Skakel oor na strookbenatting of selfs drup besproeiing waar die tekorte ernstig is. Op die manier word oppervlakverdamping beperk.

3. Bemesting

- Volg normale bemestingspraktyke.
- Bemesting by blom en ses weke daarna moet saam met die besproeiing wat vir daardie tydstip geskeduleer is, toegedien word.
- Ses weke na volblom bemesting moet aangepas word indien vrugte strawwer uitgedun word.
- Waak teen oorbemesting met stikstof. Geil groei is ongewens wanneer daar 'n tekort aan water is omdat blaaroppervlakte en dus transpirasie verhoog word.
- As die naoes periode droog is, kan daar gedeeltelik in die stikstofbehoeftes van die boom voorsien word met Ureum bespuitings (1.5kg/100L). Herhaal drie tot vier keer met 14 dae tussenposes. Die na-oes voedingsbehoefte kan nie deur spuite vervang word nie.
- Meet deurlopend die EC van die water indien brak toestande mag voorkom. Die EC moet in ag geneem word met die fertigation program.

4. Effektiewe besproeiing

- Sorg dat die besproeiingstelsel doeltreffend werk. Let veral op filters, stukkende en verstopte spuite, posisie van die spuite, onkruide en lae takke wat waterverspreiding versteur en verseker dat die stelsel teen die korrekte druk funksioneer.
- Besproei in die nag wanneer verdamping verliese baie minder is as in die dag.
- Besproei minder kere, maar langer besproeiings op 'n slag om verdamping verlies van die oppervlak te beperk. Moet egter nie te veel besproei en sodoende water deur diep perkolasie verloor nie.
- Maak profielgate in die boomry en bepaal waar 80% van die boom se wortels gekonsentreer is. Slegs hierdie area moet met elke besproeiing benat word.
- Gaan grondwatermeetinstrument (continious logging probes) opstellings na en maak seker dat die opstelling die grondeienskappe en wortelverspreiding in die

boord reflekteer.

- Hou rekord van elke besproeiing en besproei in kubieke meter per ha en nie in ure nie.

5. Besproeiingskedulering

   - Maak weekliks ‘n profielgat en gee proefielgat ’n punt uit 5, waar 1 droog is en 5 nat. Hou rekord van die profielgat evaluering.

   - Gebruik watermeetinstrumente soos “continuous logging”, tensiometers en neutronvogmeters.

   - Om te meet is om te weet.

6. Somersnoei

   - Verwyder alle waterlote so vroeg as moontlik. Blare is die grootste verbruiker van water – deur oortollige blare te verwyder word water verbruik verminder.

   - Beheer groei met groeiremstowwe soos Regalis.

7. Oesbeheer

   - Uitdun moet so gedoen word dat ’n aanvaarbare vruggrootte en blaar/vrugverhouding met die beskikbare water verkry sal word. Uitdun moet so vroeg as moontlik gedoen word en eerder strawwer as normaal om die negatiewe effek van onder besproeiing op vruggrootte te minimaliseer.

8. Besproeiing van jong bome

   - Baie water kan bespaar word by jong bome wat nog nie baie produseer nie. Die oes van sulke bome moet egter nie totaal verwyder word nie aangesien bome met vrugte aan beter oorleef as bome wat geen oes aan het nie. By jong bome kan tot meer as die helfte van die water wat besproei word verlore gaan a.g.v. oppervlakverdamping.

   - Skuif die mikrospuit tot by die boom en verklein die area wat benat word deur die roteerder of statiese verspreider se benatte area te verklein. Wees versigtig dat daar nie afloop plaasvind nie. Bedek die benatte area met ’n deklaag om oppervlak verdamping verder te verminder.

9. Windbreke

    - Sit krane op windbreke of staak besproeiing.

    - Indien die windbreek se wortels binne die boord ingroei kan ‘n skeurtandploeg gebruik word om die wortels af te sny sodat die windbreek nie by die boord gaan water steel nie. Dit sal die kompetisie vir water tussen die boord en windbreek tydelik verminder.

10. Benut boorgate en dreineerwater optimaal

    - Pomp dreineerwater terug na damme.

    - Bevestig egter waterkwaliteit van albei bronne alvorens dit benut word.

11. Maak van ’n akkurate weervoorspeller gebruik.

    - Beplan skedulerings voor voorspelde hittegolwe.

12. Pas waterbeperkings op plaas toe

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Voorbeeld van besproeiingskedulering met 50% water

Die volgende aannames is gemaak:

1. 'n Golden Delicious boord benodig 8000m^3/ha/seisoen. Met slegs 50% van water voorraad is daar dus 4000m^3/ha/seisoen beskikbaar.

2. Gestel dit is 'n Golden Delicious appelboord in die Koue Bokkeveld met volblom 11 Oktober en oes 7 Maart.

3. 'n Besproeiing waar die volle wortelsone benat word is 'n 200m^3/ha. Dus met 4000m^3/ha is daar water vir 20 besproeiings.

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Voorgestelde strategie:

1. Een besproeiing tydens seldeling en reserveer een besproeiing vir na-oes (om na-oes bemesting in te was) van 200m^3/ha elk.

2. Die periode van 40 dae na volblom tot end oes is 108 dae en daar is water oor vir 18 besproeiings @ 200m^3/ha per besproeiing. Die 18 besproeiing moet dus geskeduleer word met ’n 6 dae interval oor die tydperk, afhangend van grondvog en weersomstandighede.

   Let wel: Die waterhouvermoë en dus besproeiingsintervalle sal vir elke scenario verskil en dus moet die som vir elke scenario gedoen word.

Hierdie artikel is saamgestel uit die volgende drie bronne:

I. *Droogtebestuur dokument* deur M. du Preez,
II. *Orchard Management during periods of limited irrigation water* deur T. Volschenk (LNR Infruitec-Nietvoorbij 06-09-2000)
III. *Irrigation strategies for apple production in the Koue Bokkeveld* deur T. Volschenk (SA Fruit Journal April/May 2013).

En Louis Reynolds van Fruitful Crop Advice in Ceres (foto, onder).

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Critical water shortages

Irrigation Guidelines for Deciduous Fruit Trees

Droughts require that each drop of water be used as economically and efficiently as possible. The greatest water savings can be made early and late in the season.

The principle is to save water during the cell division phase, namely from budding until 40 days after bloom in the case of pome fruit or from budding until the end of stone hardening in the case of stone fruit, because during this stage of development the tree is not very sensitive to water shortages and controlled water tension will not have a significant effect on fruit size. Furthermore, it is a period of the season with lower evapotranspiration, which results in a lower water demand.

The second phase during which water can be saved is at postharvest, for both stone and pome fruits. This is the time when the tree supplements its reserves. Research carried out, in the Koue Bokkeveld, into water shortages during specific phenological stages of Golden Delicious apples determined that a very dry postharvest water regime (90% withdrawal of the plant-available water) had little effect on fruit size and the following season's production. (Note that 90% withdrawal is an extreme – not a target withdrawal.)

The period during which the available water should be maximally used for irrigation is during the cell enlargement and maturation phases, basically from 40 days after bloom until, and including, harvest.

Important determining factors pertaining to irrigation during water shortages

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- How much water is available for irrigation?
  - The amount of irrigation water available will determine the level of water saving.

- Phenological phase
  - Water can be saved during the cell division and postharvest phases. The period when cell enlargement takes place in pome fruit and stone hardening in stone fruit must be determined on an orchard basis.

- Prioritise orchards
  - The irrigation strategy of highly profitable orchards will differ from that of less profitable orchards. This is the year when poor orchards should be removed.

- Soil properties
  Soil properties have a great influence on the amount and regularity of irrigation. The following factors often occur in combination, and should be considered in totality. Orchards on soils that are not well buffered against water shortages must be identified and correctly managed.

  - Water holding capacity of the soil
    - Irrigation of soil with a higher silt and clay content (heavier soils) may commence later than irrigation of sandy soil, and with longer irrigation intervals, provided that the soil was saturated at the beginning of the season.
    - Irrigation of soil with a high stone fraction should begin earlier and irrigation should be carried out more regularly than for soil with a low stone fraction, or when such a fraction is absent.

  - Soil depth and root depth
    - Mature orchards utilise most of the soil volume until a limiting layer is reached. The size of the utilised soil volume has a direct effect on the size of the reservoir from which the tree draws water and largely determines how much water must be given and how regularly.

  - Young orchards
    - The root system of a young tree is very small and initially does not utilise the full soil volume. The reservoir from which the young tree draws water is therefore smaller. Again, it influences the amount of water that must be given, and the frequency of irrigation.

  - Topography and slopes
    - Irrigation will commence later on cooler southern slopes and low-lying areas.
    - Warm northern and western slopes should be irrigated more frequently due to higher evapotranspiration.
    - Identify wet orchards or areas where irrigation will commence later.
    - Orchards in high-lying areas will dry out more quickly. Due to underground drainage of water, orchards in low-lying areas will often be irrigated less frequently.

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Water saving practices

1. Exclude weed competition
   - Kill weeds on the wetted area.
   - Kill weeds over the entire area.
   - Do not till the soil because it destroys surface roots that utilise dew and low rainfall events.

2. Reduce surface evaporation
   - Cover the ground with a mulch of coarse, dead plant material (straw, grass, or rotted sawdust). Mulch is better than no mulch.
   - Change to strip wetting or even drip irrigation in cases where water shortages are serious. Surface evaporation is then limited.

3. Fertilization
   - Follow normal fertilization practices.
   - Fertilization at bloom and six weeks thereafter must be applied together with the irrigation scheduled for that time.
   - The fertilization at six weeks after full bloom should be adjusted if fruit are thinned more severely.
   - Guard against over-fertilization with nitrogen. Lush growth is undesirable when there is a shortage of water because leaf area, and hence transpiration, is increased.
   - If the postharvest period is dry, the nitrogen requirements of the tree can be partially supplied with urea sprays (1.5kg/L). Repeat three to four times at intervals of 14 days. The postharvest nutrient requirements cannot be replaced by sprays.
   - Should brack conditions prevail, continually measure the EC of the water. The EC must be taken into account with the fertigation programme.

4. Effective irrigation
   - Ensure that the irrigation system functions efficiently. Take note of filters, broken and blocked applicators, the position of the applicators, weeds and low branches that will interfere with water distribution, and ensure that the system functions at the correct pressure.
   - Irrigate during the night when evaporation losses are far less than during the day.
   - Irrigate fewer times, but apply longer irrigations at a time to limit evaporation loss from the surface. However, do not irrigate too much and thereby loose water through deep percolation.
   - Dig profile holes in the tree rows and determine where 80% of the trees' roots are concentrated. Only this area must be wetted.
   - Check the set-up of groundwater measuring instruments (continuous logging probes) and ensure that they are aligned with the soil properties and root distribution in the orchard.
   - Keep record of each irrigation and irrigate in cubic metres per hectare, not in hours.

5. Irrigation scheduling
   - Dig a profile hole, weekly, and give it a score out of 5, where 1 is dry and 5 is wet. Keep record of the evaluation of the profile hole.
   - Use water measuring instruments such as continuous logging probes, tensiometers, and neutron moisture probes.
   - To measure is to know.

6. Summer pruning
   - Remove all water sprouts as early as possible Leaves are the greatest consumers of water – by removing excess leaves, water consumption is reduced.
   - Control growth with growth retardants such as Regalis.

7. Harvest control
   - Thinning must be carried out in such a manner that an acceptable fruit size and leaf/fruit ratio is obtained with the available water. Thinning must be done as early as possible, and rather more severely than normal, to minimise the negative effect of under-irrigation on fruit size.

8. Irrigation of young trees
   - Much water can be saved in the case of young trees that do not yet bear much. The crop on such trees must, however, not be removed entirely because trees with fruit survive better than trees without fruit. In the case of young trees, up to more than half the water irrigated can be lost due to surface evaporation.
   - Move the micro sprinklers next to the tree and reduce the area to be wetted by reducing the wetting area of the rotator or static distributor. Be careful that no run-off takes place. Cover the wetted area with a mulch to reduce surface evaporation further.

9. Wind breaks
   - Place stopcocks on windbreaks or stop irrigation.
   - Should the roots of the windbreak grow into the orchard, a ripper tine can be used to cut off the roots to ensure that the windbreak does not steal water from the orchard. This will temporarily reduce the competition for water between the orchard and the windbreak.

10. Use boreholes and drainage water optimally
    - Pump drainage water back into dams.
    - First confirm the quality of both water sources before use.

11. Make use of an accurate weather predictor
    - Plan schedulings prior to predicted heat waves.

12. Restrict water use everywhere on the farm.

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Example of irrigation scheduling with 50% water

The following assumptions are made:

1. A Golden Delicious orchard requires 8000m^3/ha/season. With only 50% water supply there is therefore 4000m^3/ha/season available.
2. Suppose it is a Golden Delicious apple orchard in the Koue Bokkeveld with full bloom 11 October and harvest 7 March.
3. An irrigation that wets the entire root zone requires 200m^3/ha. Therefore, with 4000m^3/ha available, there is water for 20 irrigations.

Proposed strategy:

1. One irrigation during cell division and reserve one irrigation for postharvest (to wash in postharvest fertilization) of 200m^3/ha each.
2. The period from 40 days after full bloom until the end of harvest is 108 days and there is water remaining for 18 irrigations @ 200m^3/ha per irrigation. The 18 irrigations must therefore be scheduled with a six-day interval over the period, depending on the soil moisture and weather conditions.

   Note: The water retention capacity and thus irrigation intervals will differ for each scenario, hence calculations must be carried out for each scenario.

This article was compiled by Louis Reynolds of Fruitful Crop Advice, Ceres (photograph below), from the following three sources:

i. Droogtebestuurdokument (Eng: Drought control document), by M du Preez.
ii. Orchard management during periods of limited irrigation water, by T. Volschenk (ARC Infruitec-Nietvoorbij 06-09-2000).
iii. Irrigation strategies for apple production in the Koue Bokkeveld, by T. Volschenk (SA Fruit Journal April/May 2013).

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