



TWIN - WINNING AIR



HARDI - The Sprayer

Up to 100% more spray capacity

Reduced drift - Optimal field timing

Save up to 30% on chemicals

Better penetration in the crop

WORLD'S BEST TWIN

The TWIN concept is a unique HARDI feature, which was developed based on the experiences from the mistblowers back in the 70s and 80s.

Both case stories from the end-users and the many tests and proofs which have been coming in the last 25 years show that farmers that invest in a HARDI TWIN, invest in a sprayer in its own league.

The TWIN concept is founded in an all-round understanding and control of the application in a 3D format.

The end-user can operate with far more parameters than on a conventional sprayer, such as:

- TWIN air speed
- TWIN angle
- Can cover all angles of the plant or crop

As the following pages show, farmers using TWIN also get many more spraying hours available, increase the capacity, reduce drift and chemicals while improving their overall spraying economy.

In other words TWIN is Winning Air with more than 25 years of experience.



Improved spraying economy

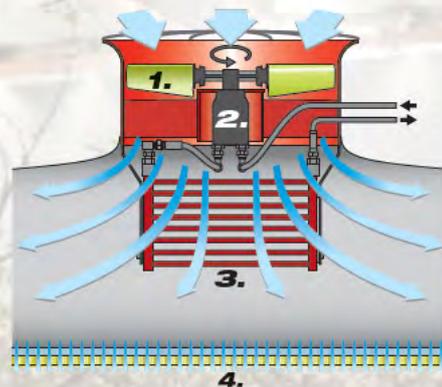
Lower water consumption

Faster spraying speeds

25 years' experience of TWIN

TWIN TECHNIQUE

Powerful blower units provide air to the left and right boom sides respectively. The large amount of air produced by the double fans allows for faster application speeds even under very difficult weather conditions. Each blower can be stepless adjusted to a maximum output of 2000 m³/h/m boom width and a maximum air speed of 35 m/sec.



- 1. TWIN fan
- 2. Hydraulic motor
- 3. Hydraulic cooler
- 4. TWIN air slot

Up to 100% more capacity

Spray drift from conventional sprayers can be so heavy that the operator has to stop before the spray job is finished. With efficient drift control it is much easier for the operator to be able to spray the entire field in one operation.

In most conditions, farmers using the TWIN sprayer get at least twice as many hours available for a safe and efficient spray job as with conventional sprayers.



Forward angling up to 40°



No angling



Backward angling up to -30°





SAVE MONEY ON YOUR SPRAYING BUDGET

From the large number of markets where TWIN has been driving, the feed-back from end-users is often that they get an increased capacity and a better efficacy of the chemicals used per hectare.

Both benefits improve the farmer's overall economy.

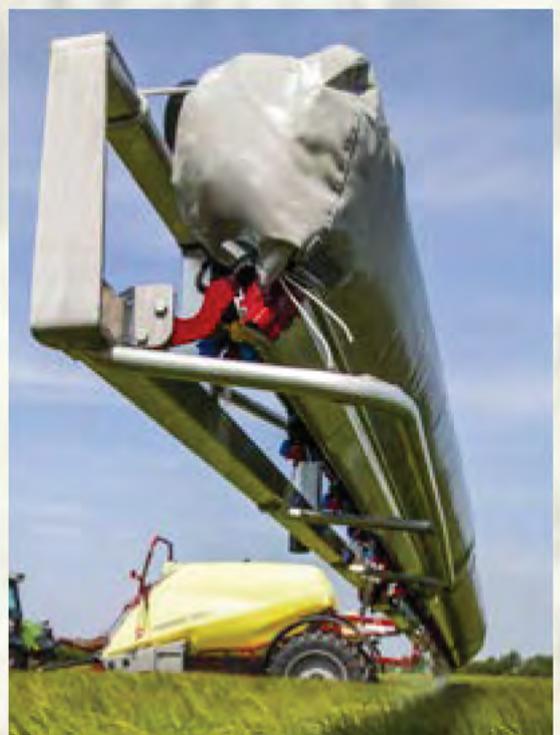
Up to 100% more spray capacity

Faster spraying speed, less filling due to smaller water consumption and more spray hours during the season give the possibility to increase the spray capacity up to 100%.

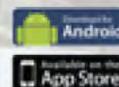
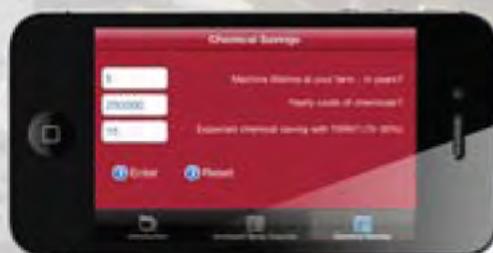
Save up to 30% on chemicals

Many trials throughout the years have shown a better chemical efficacy using TWIN. This gives the opportunity to adjust the chemical dose, and at some markets we see up to 30% reduction in chemicals consumption at the farm through the season.

At the next page we have setup to two examples of capacity gains and chemical savings with TWIN.



ENTER YOUR NUMBERS AT WWW.HARDI-TWIN.COM TO SEE HOW MUCH MONEY YOU CAN SAVE



Example 1:

Gaining extra capacity with TWIN

Input	Output at TWIN calculator	Output
Your sprayed area in ha per year?	4500	Result - work rate ha/h - conventional: 12.6
Sprayer tank capacity in litres?	4500	Result - work rate ha/h - TWIN: 20.7
Boom width in metres?	24	Result - hours per year - conventional: 357
Time for filling, mixing and transport in hours?	0.5	Result - hours per year - TWIN: 217
Amount of water in l/ha - conventional?	240	Result - your saved time in %: 39.1
Amount of water in l/ha - TWIN?	120	Result - your extra capacity in ha per year: 2885
Driving speed in km/h - conventional?	8	Result - Saved hours per year: 140
Driving speed in km/h - TWIN?	12	

Use TWIN and save 140 hours/year (39%) or spray an extra 2885 ha/year using the same hours as conventional spraying.

Example 2:

Chemical savings with TWIN

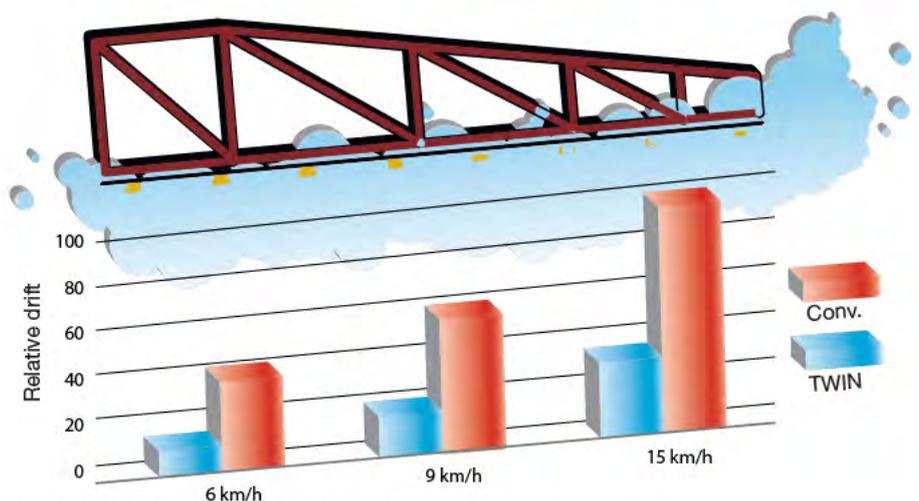
Input	Output at TWIN calculator	Output
Machine lifetime at your farm - years?	7	Cost of chemicals in the period: 1,050,000
Yearly costs of chemicals?	150,000	Result - You save in the total period using TWIN: 315,000
Expected chemical saving with TWIN? (10-30%)	30	Result - You save per year using TWIN: 45,000



AIR OFF

The HARDI TWIN booms offer the ultimate in capacity, weather independence and application technology.

DRIFT REDUCTION AND OPTIMIZED SPRAYING + 50% SPRAYING SPEED



Nozzle: ISO-F025 @ 2 bar. 6 km/h - 160 l/ha. 9 km/h - 110 l/ha.
15 km/h - 65 l/ha. Wind velocity: 2-4 m/sec. (HARDI INTERNATIONAL A/S, 2003)

Farmers around the world exploit faster spraying speeds to obtain higher capacity.

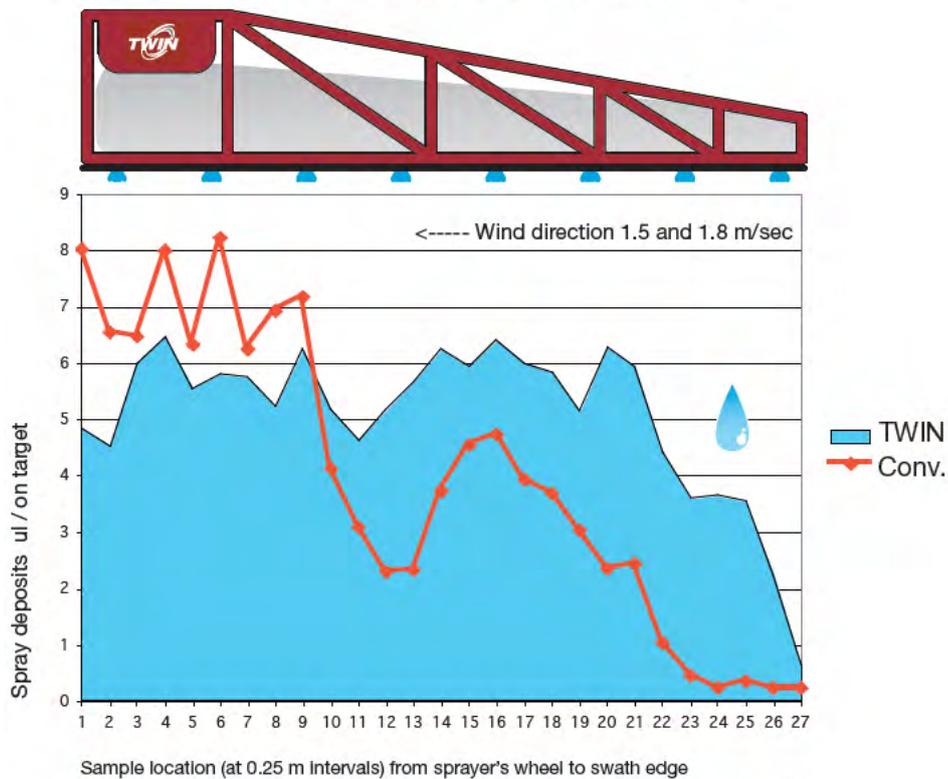
Going up in spraying speeds increases the drift cloud behind the sprayer on conventional sprayers.

The active air assistance forces the drops from the nozzle down onto the target surface and through crop canopies when needed – and drift is avoided. The air also secures the cross distribution under the boom.



In this situation the wind is about 8-9 m/s, and the drift is strongly reduced with TWIN air on.

Conventional and air assisted distribution of Fine (FF015) sprays under the upwind boom section of TWIN FORCE



(Parkin & Webb, Silsoe, 1999)

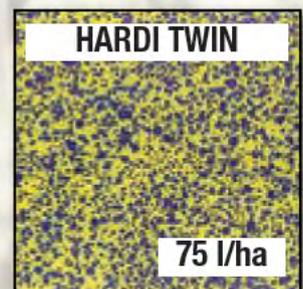
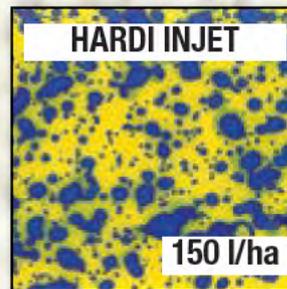
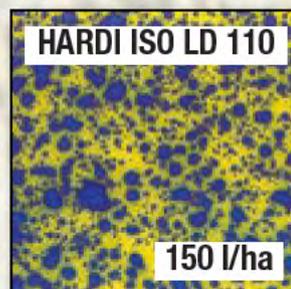
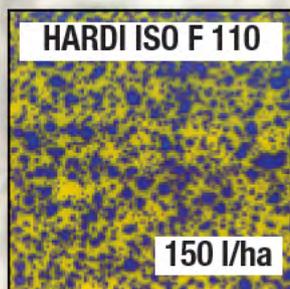
Sprayers are getting bigger and faster

These trends are causing drift concerns with conventional sprayers and are leading to poorer distribution and raising residue fears in high value crops. Poor distribution in the field will affect chemical performance and can cause crop damage and yield loss. TWIN sprayer users avoid these fears.



BETTER PENETRATION AND COVERAGE

At lower water volume - save at least 50% water



The blue colour shows the coverage on the weed

Grass weed can be difficult to control, especially when using coarse drops. The movements in the plants caused by the air assistance and the fine droplets secure a high deposit on the grass weed.

Higher deposit on the target increases efficacy of the spraying and makes it possible to reduce the chemical rate.

Excellent drift control with TWIN makes it possible to use smaller drops under a greater range of conditions.

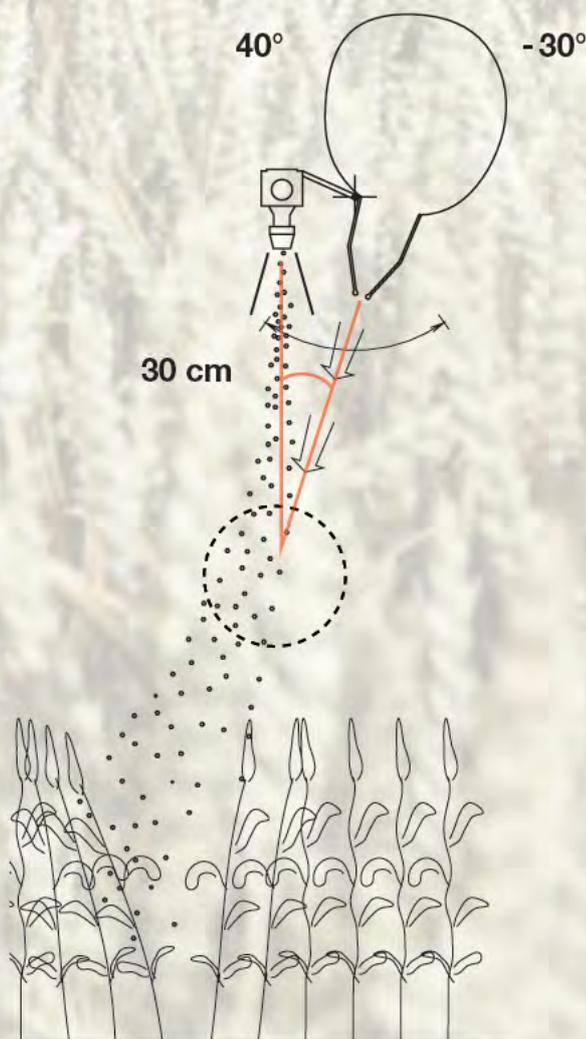
With TWIN air assistance, lower water volumes will still maintain excellent coverage over all leaf surfaces.

Typical broadacre users of TWIN are using 70 to 80 l/ha for all their products whilst high value crops such as vegetables and strawberries are at 150 to 300 l/ha.

TWIN provides massive savings in water haulage and time refilling compared to traditional spraying practices.



CROP OPENING EFFECT



The angling of the air curtain together with the spray swath is a distinctive and important feature of the HARDI TWIN. This allows for more precise application depending on crop and weather conditions.

If nozzles with fine or medium spray quality are used on a conventional sprayer (without air assistance) the on-target deposit and coverage on the backside and in the upper area of the plant is higher. The finer droplets are "hanging" in the air, meaning they need a longer time to reach the target area. This is proven in a lot of trials and can also be seen in video sequences. If there is a higher wind speed than the droplet speed, the smaller droplets are moved by the wind and the deposit and coverage gets higher on the wind side target area.

With TWIN air assistance there is a more even distribution on the whole plant. This is due to the fact that the plant is shaken by the air assistant and in this way is collecting droplets out of the air. The other effect is that fine and medium droplets are controlled by the air stream, and in this way they are safely guided towards the target, which ends up in a nice and even deposit and coverage over the full target area.

TWIN is the only air assisted sprayer with the patented possibility to angle air and liquid together in such a way that it is possible to counteract for wind direction and forward speed, without compromising on an even liquid distribution. Drop sizes can be chosen independently of air speed and volume.

Drift tests have been carried out under a wide range of different conditions and over different crops proving a very high drift reduction efficacy.

Penetration studies in dense crops like potatoes show increased deposits deep in the crop as well as on the backside of leaves.

Penetration and deposition studies, and biological efficacy tests from many countries and in a wide range of different crops have proven the efficiency of the system.

Due to the very efficient drift control over both bare ground, low and developed crops, the TWIN sprayer has a very high capacity.

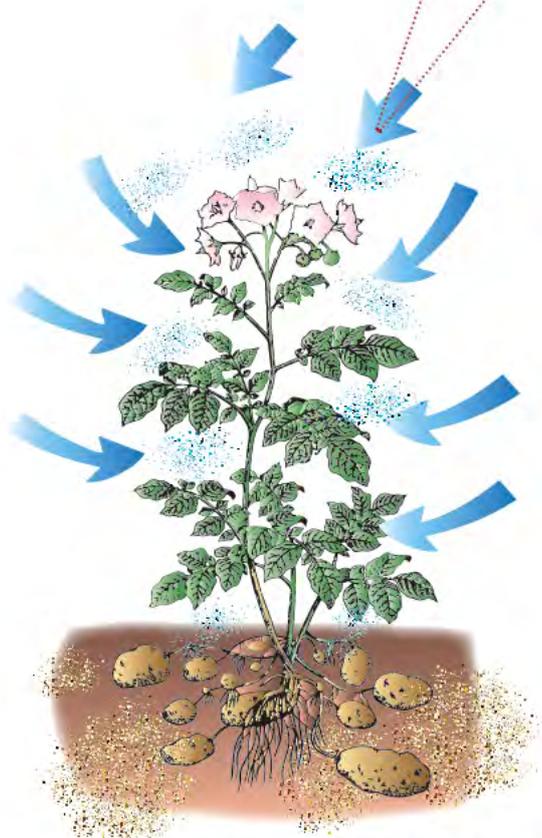
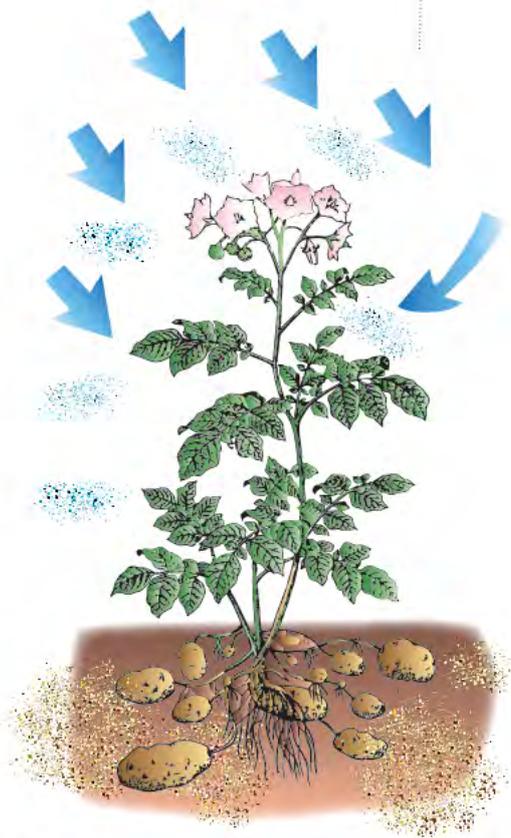


BETTER COVERAGE

Conventional spraying



Spraying with TWIN



Spraying in mid-size crops

Deposits are mainly on the topside of the plants meaning less overall coverage.

To secure a good application, high water consumption is needed. In windy conditions there will also be a need for using nozzles making coarse droplets, to avoid drift. Trials show that conventional spraying at wind speeds of 1-3 m/sec is equal to 8-9 m/sec using TWIN air assisted spraying - if you want to keep the same droplet size.

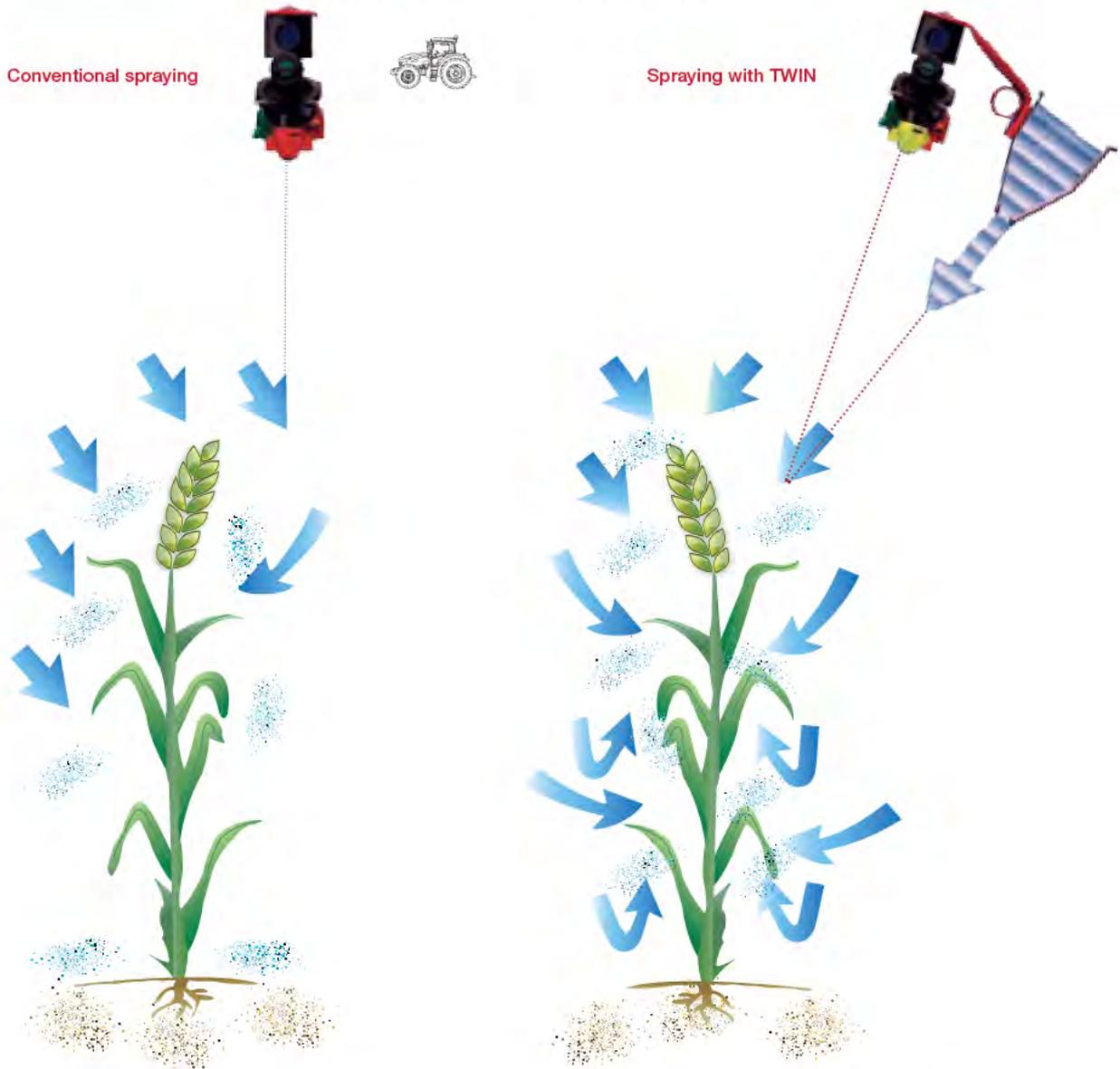
Deposits on the underside of the leaves are a big challenge for spray technique especially in dense crops. More than twice as much spray liquid was deposited on the underside of the leaves when using TWIN.

Deposit on the underside of the leaves has been measured in the upper and lower part of the canopy in % of the total deposit on the plant

Find the test results on www.hardi-twin.com



IMPROVED DEPOSIT



When fine / medium spray qualities are sprayed with conventional sprayers without air assistant, the deposit on the backside and in the upper area of the plant is higher. The finer droplets are hanging in the air.

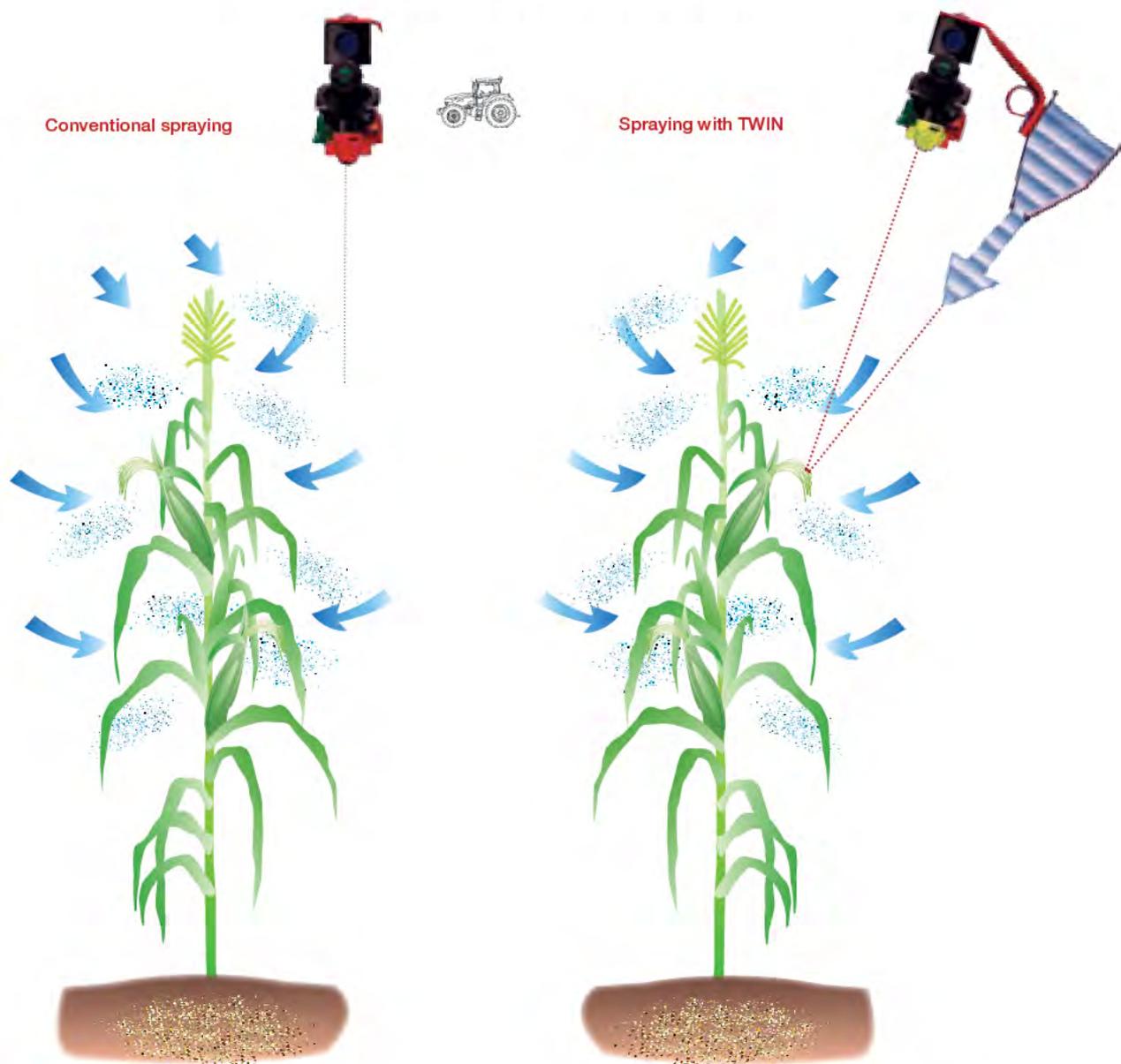
If the wind speed is significantly higher than the droplet speed, the smaller droplets are moved by the wind and the deposit gets higher on the wind side.

With TWIN air assistance there is a more even distribution on the whole plant. This is due to the fact that the plant is shaken by the air and is collecting droplets out of the surrounding. In this case the droplets are controlled by the air.

This better and more even coverage can be seen in a lot of field trials and in video sequences in the HARDI spray laboratory.



EXCELLENT PENETRATION



Spraying in high crops

TWIN air assistant reaches an excellent result in tall crops and that also in later growth stages. The air allows a far deeper penetration into the crop and the fine droplets give a good coverage. Finer droplets also stay on the target area, where coarse droplets from conventional injector nozzles could run off or bounce down.

Especially on insecticide applications, fine droplets and a more even coverage give a better result. In late growth stages, it is often difficult to reach the target area. In corn, for example, the cob is deep in the crop and difficult to reach. Fungicide spraying in flowering oilseed rape needs to be deep in the canopy as the infections are on the raceme.

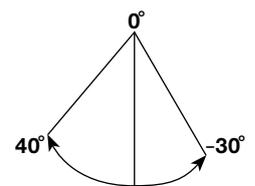


Spraying in dense crops

In dense crops, such as vegetables or potatoes, it is difficult to penetrate the crop. Coarse droplets from a conventional sprayer could penetrate deeper, but they cannot open the crop or lift leaves up.

With the unique angling of the nozzle/air system, a TWIN sprayer is able to open the crop and reach a good coverage on the underside of the leaf.

The crop opening effect can only be reached if the air comes in an angle towards the canopy. Vertical air would close the canopy and result in a high deposit just on top of the crop.



FOURTH GENERATION HARDI

With more than 27% of the total land of Netherlands being worked crops, the country is the second largest exporter of agricultural products after the US. This puts Netherlands in the leading position with machinery and equipment, to work its many special crops. Paul Krol is a great example of this.



In 1986, together with his brother, he took over a farm with 5 ha of potato seeds, 10 ha of sugar beets and 20 ha of potatoes for potato fries.

“We now have 400 ha in total with potato fries as the main crop counting for 280 ha. Then we have 10 ha of seed potatoes, 20 ha of sugar beets, 30 ha of peas, some carrots and the rest being corn”, Paul says. “Over the last 5 years we expanded from 200-400 ha, which has made it even more important to have the right equipment.”

Different track widths

Paul Krol bought his first ALPHA 6 years ago, after driving two COMMANDER's. After covering 15,000 ha with the ALPHA, it was time to get a new model. Last year Paul invested in an ALPHA evo VariTrack with a 28 m TWIN FORCE boom.

We need to change track width when going from corn, where we drive with 2.25 m track widths, to potatoes where we drive with 1.80 m track widths. The 28 m boom fits perfectly in our relatively small fields where every corner is a sharp corner”, Paul says.

The area the Krol family lives in, is quite dry with lots of the fields being with sand ground. Therefore Paul has to water the fields. The range of the water equipment fits perfectly with the 27 m width Paul is allowed to spray.

“Due to government regulations, we have to remove the outer nozzles. The liquid must not exceed the width of the boom. Also in the Netherlands, conventional sprayers cannot drive closer than 1.5 m to the edge of the field, but with equipment like the TWIN FORCE boom, we can drive as close as half a meter”, Paul Explains.

Precision spraying

“In addition to the manoeuvrability, the reason why we bought the ALPHA was the TWIN system. With this we are easily able to drive 15 km/h, also in windy conditions, with only 100 l/ha. This makes us able to cover 25 ha with only one tank of water”, he says. “With this, we have a much bigger spray window, while saving money at the same time - about 10% of chemical consumption every year.”

“We have also prevented fungus attacks in our peas. With the ability to angle the air, and thereby lifting the leaves of the plants, we are able to cover the whole of the stock.”

“The tendency of Dutch farming is definitely going towards bigger farms, and we are, of course, also planning on going bigger at one point. At the moment we are already very busy in the fields, but let's see, our two oldest boys are both into farming, so when the time is right and the price for land is at a decent level, we will also expand the hectares we have today.” Paul finishes.



Paul and Monique Krol

ALPHA evo VariTrack, 28 m TWIN boom

Working speed: 15 km/h

Transport speed: 45 km/h

Amount: 100 l/ha

Sprayed area per day: 100 ha in 8 hours on 3 ha fields

Sprayed area a year: 4.500 ha

Farm size: 400 ha.

Crops: Seed potatoes, fries potatoes, sugar beets, peas, carrots, corn.

THERE IS A HARDI TWIN FOR ALL NEEDS

MASTER plus TWIN STREAM 1000-1200 I

Liftmounted sprayers

12 or 15 m boom width

Air speed: 0-30 m/s

Air volume: 0-1500 m³/hour per m boom

Angling: 18° forward - 18° backward

Good economy and high capacity



COMMANDER TWIN FORCE 3300-4500-5500-7000 I

Trailed sprayers

18 to 36 m boom width

Air speed: 0-35 m/s

Air volume: 0-2000 m³/hour per m boom

Angling: 40° forward - 30° backward

Supreme capacity and unsurpassed spraying technique



ALPHA evo TWIN FORCE 3500-4500 I

Self propelled

18 to 36 m boom width

Air speed: 0-35 m/s

Air volume: 0-2000 m³/hour per m boom

Angling: 40° forward - 30° backward

Highest comfort and supreme capacity



The Sprayer

About HARDI - The Sprayer:

We are an international group, whose basic idea is to satisfy the user's requirements for quality products ensuring efficient, punctual and precise application of crop protection products.

Our worldwide distribution and sales network comprise more than 100 countries where we are represented by importers, agents and sales subsidiaries.

HARDI INTERNATIONAL A/s

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