FREQUENTLY ASKED QUESTIONS

GENERAL

XPS, XPower™ and Electroherb™

- The XPS was adapted by Zasso to address the specific weeding needs of special crops such as wine: compactness and ease of use.
- The XPS is part of the pioneering family of electric weeding solutions under the XPower™ brand launched by AGXTEND™ and Zasso.
- Electroherb™ represents the treatment of plants with electricity, as understood and operated by Zasso. It's this technology which is used by the XPS system.

How does the system work?

- The Electroherb™ is a non-selective, systemic herbicide.
- The basic principle of the solution is the application of a lethal dose of electrical energy to plants and roots via electrodes that are in contact with the plants.
- It works as a closed electrical circuit: the high-voltage electricity is generated locally from the mechanical energy of the tractor. The electric current passes via the electrode into the plants and then into the soil. The electric circuit is closed via a second electrode that either touches other plants or the soil.

What is the mode of action?

- The mode of action of the Electroherb™ is best compared with that of systemic chemical herbicides such as glyphosate, but with the added advantages of non-resistance, non-residues, non-drifting and, thus, no environmental or social impact.
- The applied energy causes cell walls and membranes to burst. Primarily, the electrical energy destroys the vascular bundles, the main arteries for water and nutrient supply of any plant right down into the roots and alters the process of photosynthesis. Cell sap leaks and let the plants dry out from the inside.

What are the components of the XPS?

- The XPS consists of a back unit and a set of two side applicators:
    - The back unit includes a generator, a gearbox, 8 power units and an electrical control cabinet.
    - The applicator consists of two static electrodes and two electrodes swinging on three passive rotary axes.
- Special attention was given to the kinetics of the intercept arm to optimize the weeding area while respecting the integrity of the stems.
- As a rear solution, the XPS is mounted on a hydraulic frame; 200 mm extensions on both sides can be added, if necessary.
- Front options are possible using standard SB Compact, SB2 and SB Orchard frames from Clemens GmbH & Co.

What is the overall weight of the XPS?

- Total weight: approximately 1.200 kg
- Key components:
    - Frame: 422 kg
    - Generator and gearbox: 302 kg
    - High voltage units: 216 kg
    - Two applicators: 2 x 36 kg
    - Control cabinet: 100 kg

Of what materials are the electrodes made?

- The electrodes are made of stainless spring steel, flexible and conductive so that it can easily transmit the power into the targeted plants.
- All attachments are made of glass reinforced plastic (GRP).
- Zasso is currently testing various thicknesses and lengths of electrodes to optimize the efficiency of the system.
- The expected lifetime of the electrodes is about one year, but this can vary depending on the working conditions.

What are the characteristics of XPS?

Application	Vineyards
Implement dimensions	Length 1603 mm; height 1490 mm Adjustable width between 1556 mm and 2096 mm
Extensions	200 mm available on both sides
Vine width	From 1.50m to 4.40m depending on the configuration
Width of electrical application	500 mm on both sides
Weight	Approx. 1200 kg
Energy	Tractor used to produce high voltage electricity
Speed	Up to 4 km/h
Power	24 kW
Voltage	8,000 V
Power requirements	75 HP
PTO Speed	540 rpm
Hydraulics	1 double acting is required

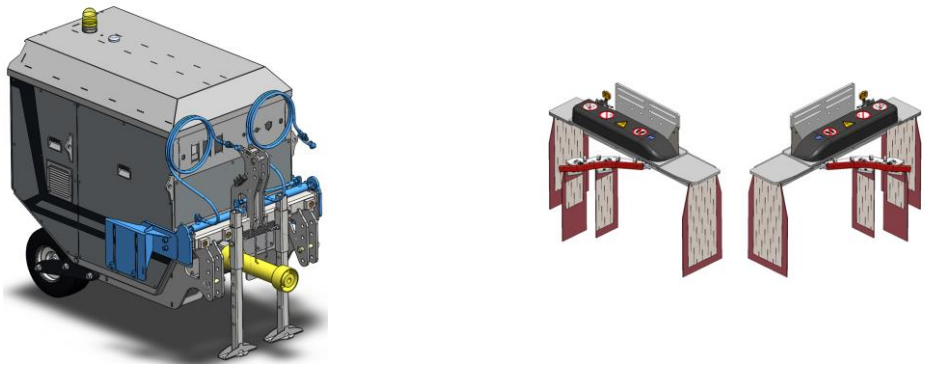


Figure 1: XPS: pictures of the 24kW supply unit & XPV 2.0 applicators

BENEFITS

What are the advantages compared to chemical weeding?

- Fast and durable action: it is residue-free and can be applied weather independently.
- It does not lose its effectiveness in case of rain after application, unlike chemical weed killers.
- The XPS user is not exposed to toxic substances.
- Neither the soil, water nor insects are affected during the application.
- Electroherb™ applications are not subject to legal restrictions and can be applied in all areas, e.g. along water ways.
- Electroherb™ is a useful additional tool towards partial or total herbicide-free wine or food production.

What are the advantages compared to non-chemical weeding?

- Electroherb™ has a systemic action down into the roots: other non-chemical methods generally are not systemic, which provokes re-growth.
- Electroherb™ has no impact on the soil: prevention of erosion risks and no stimulation of the weed seed stock or nutrient turn-over.
- Soil intactness: the energy runs directly into the roots and does not heat up the surrounding soil or the environment.
- Optimized kinematics: good coverage between the vines thanks to an applicator that pivots on three rotation points.

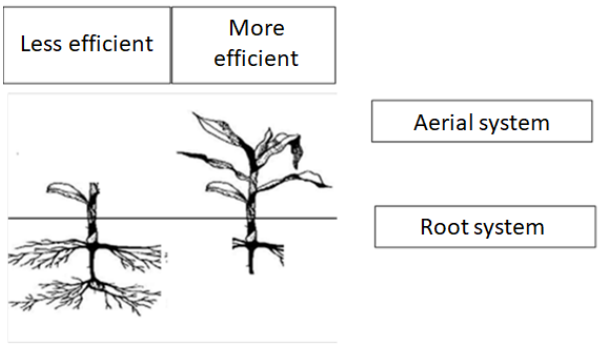
AGRONOMIC CONSIDERATIONS

On which types of weeds is the XPS most effective?

- The efficiency of electro-physical plant treatment in the field depends, in specific, on the plant species, the morphology, the growth stage and the population density.
- Generally spoken, the treatment is relatively more effective on dicotyledons than on monocotyledons and on plants between 2 cm and 20 cm in height.
- The more complex the root system is, the more power would be required to achieve an efficient result to kill the below-ground root mass because the captured energy will be diluted.
- The higher and denser the targeted weed population is, the higher is the risk of the electrodes not being in contact with each plant, reducing the efficiency level.
- Zasso advises specific weeding strategies in terms of speed and power combinations to ensure good results, independent of the weed density.

What is the theory behind the XPS's electrical weeding solution?

- From an electrical perspective, the plant can be considered as a resisting system in two main parts, the aerial plant system and the subterrestrial root system.



- Plants with a low number of stems and low root volume relative to its aerial system (morphologically typical for dicotyledons) will require less energy and can be damaged more easily as the electrical energy, which passes through the plant interacts with less plant tissue and the critical lethal thresholds are reached faster. In the contrary, weeds which have a lot of stems, or which are densely populated and have large root volumes (morphologically typical for monocotyledons) will require more energy, to reach the critical threshold of a lethal damage.
- A satisfying treatment result occurs when the amount of power consumed by the roots of the targeted plant is sufficiently high enough (the lethal threshold was reached) to neutralize any re-growth.
- The below mentioned factors will also influence the power consumption:
    - The amount of power applied to the plant.
    - Plant characteristics: varying root structure, stem width, size of leaves and plant densities.
    - The speed of the tractor.
    - Distance between electrodes.
    - The soil impedance, influenced by general soil characteristics (clayey, sandy, silty) and the soil moisture.

What is the most ideal situation for effective Electroherb™ weed control?

- The Electroherb™ works best in populations with re-growth of young dicotyledon plants. Mixtures of monocotyledon and dicotyledon plants can also be treated effectively.
  However, the application must take place before monocotyledon plants overgrow the dicotyledons. If the growth is advanced, the application speed needs to be reduced to increase the energy consumption by single plants.

What are the limitations of Electroherb™ treatment?

- Energy consumption is related to weed density, which means that in places with higher weed density, the application will have to spend more energy per area or plant. This can be achieved by higher energy output or reduced driving speeds.
- Old, dense monocotyledon plant populations with highly developed root systems, especially if already mown in the past, are limiting treatment efficacy. In those cases, more than one treatment, with very high energy doses is required the first time throughout the area.

How long does it take to see the effects?

- Electroherb™ interrupts the water supply of the targeted weeds within a few seconds after touching them. Depending on the weather and plant species, it can take from a few minutes to several days before the wilting and drying out of the plants is visible.

What is the expected regrowth period?

- A reduced re-growth can be expected. Electroherb™ method does not encourage germination because it does not stir or warm up the soil.
- Plants with larger old and developed root stocks or rhizomes are severely weakened but will likely recover from the first application.
- Depending on the season, plant species and size of the plant, a repetition of treatment once every 1 to 4 months during the growing season may be necessary.

ENVIRONMENT / SAFETY

What is the impact of XPS on soil life?

- Preliminary tests were conducted by Zasso in 2019.
- Compared to the untreated control area, the effects of Electroherb™ application were significantly lower than those of a mechanical (harrow) treatment.
- Due to the level of effect measured and lack of lasting effects (after 4 weeks) there is no reason to believe there is any long-term influence in the number of individuals of soil organism species studied so far.
- Tests performed have shown that, under realistic dosage and treatment conditions, no significant lasting effects can be found on microfauna, mesofauna (springtails and oribatid mites) and microorganisms.
- Also, in France, Zasso is collaborating with both, the French Wine Institute (IFV) and INRA Dijon evaluating the environmental impact of Electroherb™ especially in wine using the most updated Norm ISO 23611.

What is the impact of XPS on the integrity of the vine stocks?

- During application, tests with the French Wine Institute (IFV) have confirmed that the vine stock is not affected because it is isolated with its wooden bark.
- In addition, electric weeding done the fall of 2019 have not had an impact on the rate of vine budburst in the spring of 2020.

At what distance does the XPS have be placed from the vine stock?

- The XPS unit must always be aligned in parallel to the row being treated, with the applicator 10cm distant from the vines to allow for movement of the intercept swing arm. The swing arm must touch the vinestock between its two electrodes.
- Operational training will clearly explain to XPS operator the driving and application recommendations.

What are the key safety principles to keep in mind?

- The machine may only be used for the specified application.
- The machine must not be used in rain.
- The machine must not be used by persons with active medical implants (e.g. pacemakers).
- Only trained and instructed persons may operate the machine.
- Nobody must be in the field during operation of the XPS in the vineyards
- Please block-off the area of application by means of warning signs, so that third parties can see at an early stage that high voltage is currently being used in the field.
- Metal objects must not touch the electrodes.
- Please always use the insulated protective boots
- Please always make sure that the grounding chain touches the ground.
- Please ensure that there are no obstructions to visibility in the carrier vehicle when driving over (public road traffic) to the working area.

Is the XPS safe to the operator?

- Maximum operational safety is ensured through insulating materials and optimized mechanical geometries.
- Before each handling of the electrodes, check that the machine is voltage-free (ten minutes after switching off the machine) by means of the high voltage lance.
- The machine may only be repaired by trained mechanics or certified high voltage technicians appointed by the manufacturer.
- The high voltage areas of the two applicators are entirely isolated from the rest of the XPS equipment: all parts are fixed on an isolating base structure made from glass reinforced plastics, which additionally reduce the risks to the user.
- The XPS is fully compliant with European safety norms in vigor.
  A detailed Safety Quick Guide is provided to the XPS operator with all necessary instructions to be followed

Can the XPS be used in all vineyards?

- The XPS has been especially designed to be used in wide vineyards. However, due to the safety regulations related to high voltage, the XPS may not be used in vineyards which are equipped with metal irrigation systems mounted between the vines.
- Precaution must also be demonstrated in very hilly areas to ensure a good product efficiency. As long as a small tractor can be driven normally with the mounted implement, the XPS can be used for weed control.

Can the current from the XPS electrodes touch any metallic parts?

- Zasso has developed a front bumper to prevent contact of the electrode with metallic parts.
- For safety reasons, direct contact between electrodes and ungrounded metal parts must be avoided.

If XPS electrodes touch any metallic part, and someone touches a connected wire, could the person be injured fatally?

- As a result, the amount of current flow is significantly influenced by the number of earthing points.
- As the number of grounding points increases, the current in the body will decrease due to the changing current divider between body resistance and metal parts.
- It should be clear that it could be lethal to touch the metallic parts of the system during application.

Does the XPS generate electro-magnetic interferences?

- All devices and units are checked to ensure compliance with the electromagnetic compatibility (EMC) threshold values.
- No interference with communication devices within the tractor is expected.
- Electromagnetic interference (EMI) can pose a danger to operators with pacemakers and implantable cardioverter-defibrillators (ICDs). Operators with pacemakers and implantable cardioverter-defibrillators (ICDs) should not be allowed to work on XPower equipment.
- The XPS is fully compliant with EMC norms in vigor.

BUSINESS MODEL

Who will be distributing the XPS system?

- The distribution of the XPower™ product range is exclusively reserved for AGXTEND™ certified dealers.

What is meant by Zasso-accredited agronomic advisers?

- Advisers who can provide hands on Electroherb™ crop protection advice on when/how best to use the XPS to apply the Electroherb™.
- Such service will be proposed to XPS customers.

How do I become a Zasso-accredited agronomic adviser?

- The advisors will be accredited by Zasso based on their capability to provide agronomic advice on optimized technical itineraries, prepare pre-treatment diagnosis, soil analysis and weeding strategies, and ensure rapid field support.
- Upfront and ongoing Electroherb™ crop protection training will be provided by Zasso to all Zasso-accredited agronomic advisers.

How do the Zasso-accredited agronomic advisers interact with the CNH Industrial dealers?

- These advisers will be not involved into the distribution of the XPS equipment.
- These advisers may eventually purchase XPS equipment from an AGXTEND™ certified dealer in order to offer electrical weeding services to end customers.
- These advisers will charge the XPS customers directly.

Who is Zasso?

- Zasso is a partner of CNH Industrial and AGXTEND™ since November 2018.
- Together, AGXTEND™ and Zasso have launched a pioneering family of electric weeding solution under the XPower™ brand.
- Zasso is a swiss based company specialized in non-chemical weed management solutions using advanced technology.
- The company has offices in Zug (Switzerland), Indaiatuba (Brazil), Aachen (Germany) and Paris (France).
- Zasso's mission is to provide safe, efficient and viable technologies necessary for an herbicide-free world.

Warranty

- Warranty terms and conditions are following the CNH Industrial processes.

For further information

Please visit our website or social media channels.

Website: https://AGXTEND.com/products/XPower
Facebook: www.facebook.com/AGXTEND
Instagram: www.instagram.com/AGXTEND
YouTube: www.youtube.com/channel/UCd-Zn-_oZAD7tZ-dnKuJI4Q