SPISE 6 - 6th European Workshop on Standardized Procedure for the Inspection of Sprayers in Europe,
13-15 September 2016, CASTELLDEFELS (Barcelona), Spain
Session 6: Present experiences and problems in inspections activities (Thursday, 09:40 – 10:55)

„Self-inspection of spraying equipment not covered by official inspection system in Poland”

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InHort
SKIERNIEWICE

Sustainable Use Directive (2009/128/EU) in Article 8

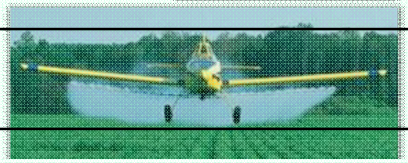
- "By way of derogation … **following a risk assessment** for human health and the environment including an assessment of the scale of the use of the equipment, **Member States may** … **exempt from inspection handheld pesticide application equipment or knapsack sprayers**.
- In this case the **Member States shall ensure** that operators have been informed of the need to change regularly the accessories, of the specific risks linked to that equipment, and **that operators are trained for the proper use of that application equipment** … ".
- In article 5 (on training) it is stated that "Member States shall ensure that **all professional users, distributors and advisors have access to appropriate training** by bodies designated by the competent authorities".

The PAE inspected in Poland

PAE / inspected from year (subsequent changes in the law)	**1999**	**2013**	**2015**
Field crop sprayers	X	X	X
Orchard sprayers	X	X	X
Railway sprayers **with boom**		X	X
Railway sprayers – **other**		X	X
Aerial spray systems		X	X
Greenhouse equipment (spraying and fogging)			X
Other sprayers (tank volume > 30 l)			X
Seed treatment equipment			X
Granule applicators			X









As for 2016-09-13

PAE exempted from inspection - handheld and knapsack sprayers

- A risk assessment for human health and the environment, based on the research and reports by:
  - Res. Institute of Horticulture, Skierniewice (presented at SPISE 4)
  - National Institute of Hygiene, Warsaw (presented at SPISE 4)
- Decision of the Ministry of Agriculture
- The need for training programme and materials (the need to change regularly accessories, risks linked to the equipment, proper use of it i.a. self-inspection).

The trials on the influence of knapsack sprayer technical condition on operator exposure as an input to the risk assessment for human health

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[1]Research Institute of Horticulture, Skierniewice, POLAND
J. K. Ludwicki[2], B. Wiatrowska[2], R. Bankowski[2]
[2]National Institute of Public Health - National Institute of Hygiene, Warszawa, POLAND

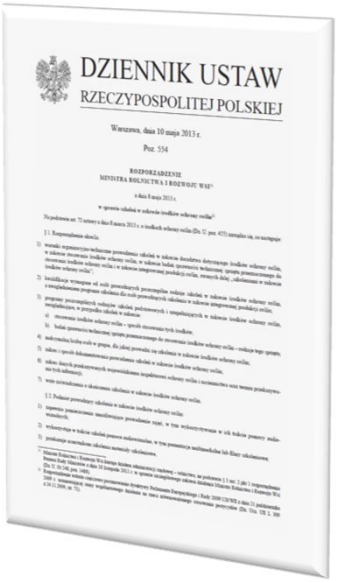
- The tests were carried out for:
  - undamaged knapsack sprayer
  - damaged nozzle
  - damaged gun valve
- The tests were carried out in:
  - low crop (strawberries)
  - medium loose crop (young orchard)
  - high dense crop (bearing fruits orchard)

- National Institute of Hygiene - operator risk for 15 pesticides (BBA model) (when >AOEL)
- The risk for operator depends on:
  - crop height,
  - Personal Protective Equipment (PPE) usage.
- In low and medium-loose crops, when PPE is used, there was no influence of the sprayer technical condition on the operator risk.
- In the high crops the knapsack sprayers should be used in the limited extent. For some pesticides the knapsack sprayers should not be used, even for efficient sprayer.

AOEL – Acceptable Operator Exposure Level: The maximum amount of the active ingredient (a.i.) of PPP on which the operator may be exposed, without any adverse effects on his health. Expressed in mg/kg of body weight.

The trainings on pesticide use in Poland

- By persons with proper competences,
- Using proper PPE and PAE's,
- According to training official programmes listed in the Ministry of Agriculture Regulation (Journal of Laws from 10 of May 2013; item no 554).

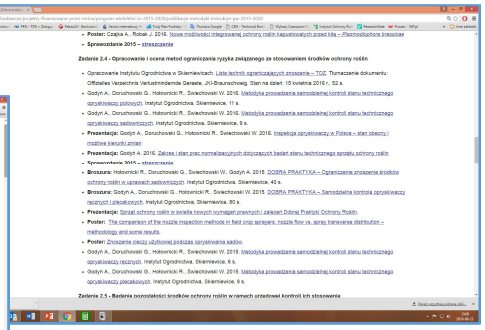


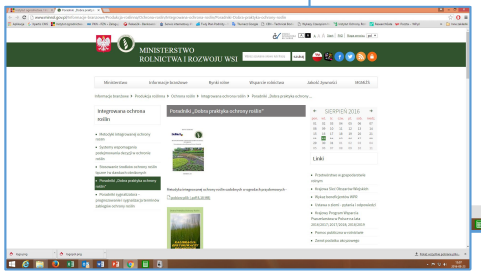
The need of self-inspection

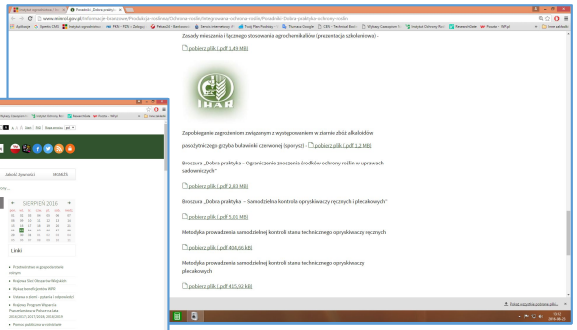
- To help the trainers and growers or applicators.
- The Ministry of Agriculture ordered the training materials on self-inspection of excluded sprayers .
- The materials were elaborated in InHort in the frame of Multi-annual Programme realised for and financed by Polish Ministry of Agriculture and Rural Development.

Two instruction manuals describing the procedure of self-inspection

- To be used by the trainers and applicators.
- Elaborated in form of questions checklist.
- Containing:
  - checklist questions
  - description of the control procedures
  - protocol of self-inspection
- Published on the web on InHort and Ministry of Agriculture webpages as a pdf's.

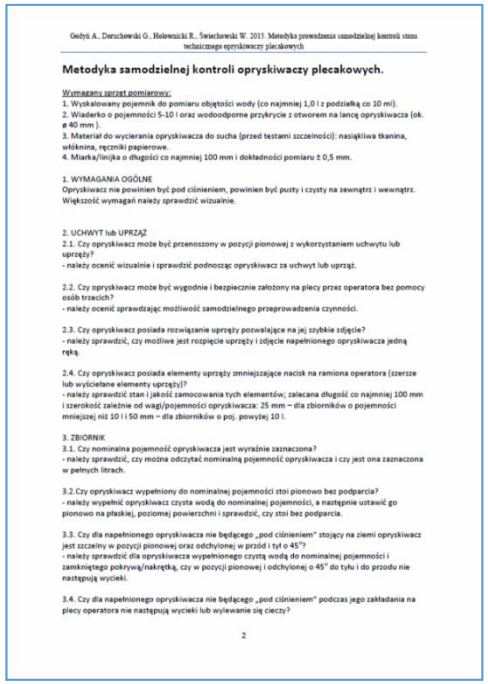






Elaborations which may be used as a training materials

- Self-inspection procedures
- Inspection protocol
- Illustrated brochure



Godyń A., Doruchowski G., Holownicki R., Świechowski W. 2015. Metodyka prowadzenia samodzielnej kontroli stanu technicznego opryskiwaczy plecakowych

Metodyka samodzielnej kontroli opryskiwaczy plecakowych.

Wymagany sprzęt pomiarowy:
1. Wyskalowany pojemnik do pomiaru objętości wody (co najmniej 1,0 l z podziałką co 10 ml).
2. Wiaderko o pojemności 5-10 l oraz wodoodporne przykrycie z otworem na lancę opryskiwacza (ok. ø 40 mm).
3. Materiał do wycierania opryskiwacza do sucha (przed testami szczelności): nasiąkliwa tkanina, włóknina, ręczniki papierowe.
4. Miarka/linijka o długości co najmniej 100 mm i dokładności pomiaru ± 0,5 mm.

1. WYMAGANIA OGÓLNE
Opryskiwacz nie powinien być pod ciśnieniem, powinien być pusty i czysty na zewnątrz i wewnątrz. Większość wymagań należy sprawdzić wizualnie.

2. UCHWYT lub UPRZĄŻ
2.1. Czy opryskiwacz może być przenoszony w pozycji pionowej z wykorzystaniem uchwytu lub uprzęży?
- należy ocenić wizualnie i sprawdzić podnosząc opryskiwacz za uchwyt lub uprząż.

2.2. Czy opryskiwacz może być wygodnie i bezpiecznie założony na plecy przez operatora bez pomocy osób trzecich?
- należy ocenić sprawdzając możliwość samodzielnego przeprowadzenia czynności.

2.3. Czy opryskiwacz posiada rozwiązanie uprzęży pozwalające na jej szybkie zdjęcie?
- należy sprawdzić, czy możliwe jest rozpięcie uprzęży i zdjęcie napełnionego opryskiwacza jedną ręką.

2.4. Czy opryskiwacz posiada elementy uprzęży zmniejszające nacisk na ramiona operatora (szersze lub wyścielane elementy uprzęży)?
- należy sprawdzić stan i jakość zamocowania tych elementów; zalecana długość co najmniej 100 mm i szerokość zależnie od wagi/pojemności opryskiwacza: 25 mm – dla zbiorników o pojemności mniejszej niż 10 i i 50 mm – dla zbiorników o poj. powyżej 10 l.

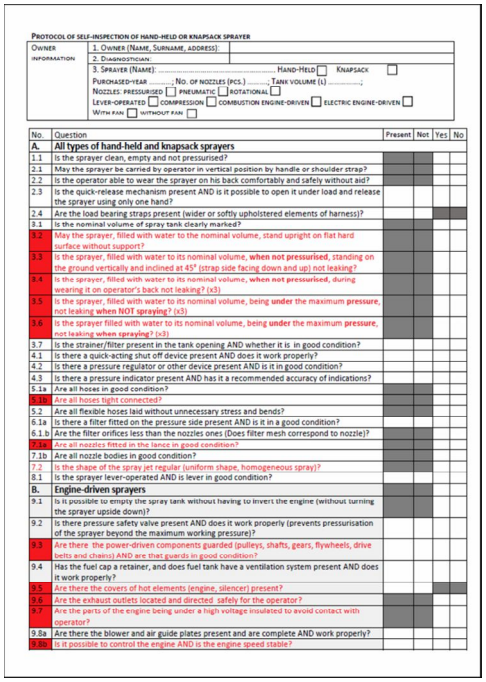
3. ZBIORNIK
3.1. Czy nominalna pojemność opryskiwacza jest wyraźnie zaznaczona?
- należy sprawdzić, czy można odczytać nominalną pojemność opryskiwacza i czy jest ona zaznaczona w pełnych litrach.

3.2.Czy opryskiwacz wypełniony do nominalnej pojemności stoi pionowo bez podparcia?
- należy wypełnić opryskiwacz czystą wodą do nominalnej pojemności, a następnie ustawić go pionowo na płaskiej, poziomej powierzchni i sprawdzić, czy stoi bez podparcia.

3.3. Czy dla napełnionego opryskiwacza nie będącego „pod ciśnieniem" stojący na ziemi opryskiwacz jest szczelny w pozycji pionowej oraz odchylonej w przód i tył o 45°?
- należy sprawdzić dla opryskiwacza wypełnionego czystą wodą do nominalnej pojemności i zamkniętego pokrywą/nakrętką, czy w pozycji pionowej i odchylonej o 45° do tyłu i do przodu nie następują wycieki.

3.4. Czy dla napełnionego opryskiwacza nie będącego „pod ciśnieniem" podczas jego zakładania na plecy operatora nie następują wycieki lub wylewanie się cieczy?

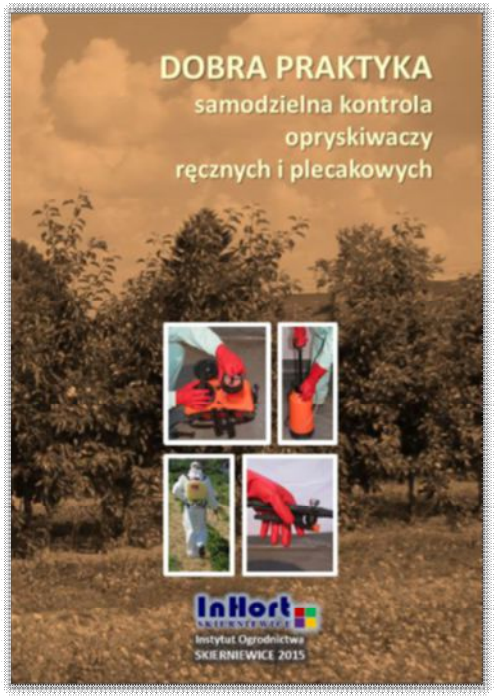
2



PROTOCOL OF SELF-INSPECTION OF HAND-HELD OR KNAPSACK SPRAYER

OWNER INFORMATION
1. OWNER (NAME, SURNAME, ADDRESS):
2. DIAGNOSTICIAN:
3. SPRAYER (NAME): ..... HAND-HELD ☐ KNAPSACK ☐
PURCHASED-YEAR ..... ; NO. OF NOZZLES (PCS.) ..... ; TANK VOLUME (L) ..... ;
NOZZLES: PRESSURISED ☐ PNEUMATIC ☐ ROTATIONAL ☐
LEVER-OPERATED ☐ COMPRESSION ☐ COMBUSTION ENGINE-DRIVEN ☐ ELECTRIC ENGINE-DRIVEN ☐
WITH FAN ☐ WITHOUT FAN ☐

No.	Question	Present	Not	Yes	No
A.	**All types of hand-held and knapsack sprayers**				
1.1	Is the sprayer clean, empty and not pressurised?				
2.1	May the sprayer be carried by operator in vertical position by handle or shoulder strap?				
2.2	Is the operator able to wear the sprayer on his back comfortably and safely without aid?				
2.3	Is the quick-release mechanism present AND is it possible to open it under load and release the sprayer using only one hand?				
2.4	Are the load bearing straps present (wider or softly upholstered elements of harness)?				
3.1	Is the nominal volume of spray tank clearly marked?				
3.2	May the sprayer, filled with water to the nominal volume, stand upright on flat hard surface without support?				
3.3	Is the sprayer, filled with water to its nominal volume, **when not pressurised**, standing on the ground vertically and inclined at 45° (strap side facing down and up) not leaking?				
3.4	Is the sprayer, filled with water to its nominal volume, **when not pressurised**, during wearing it on operator's back not leaking? (x3)				
3.5	Is the sprayer, filled with water to its nominal volume, being **under** the maximum **pressure**, not leaking **when NOT spraying**? (x3)				
3.6	Is the sprayer filled with water to its nominal volume, being **under** the maximum **pressure**, not leaking **when spraying**? (x3)				
3.7	Is the strainer/filter present in the tank opening AND whether it is in good condition?				
4.1	Is there a quick-acting shut off device present AND does it work properly?				
4.2	Is there a pressure regulator or other device present AND is it in good condition?				
4.3	Is there a pressure indicator present AND has it a recommended accuracy of indications?				
5.1a	Are all hoses in good condition?				
5.1b	Are all hoses tight connected?				
5.2	Are all flexible hoses laid without unnecessary stress and bends?				
6.1a	Is there a filter fitted on the pressure side present AND is it in a good condition?				
6.1.b	Are the filter orifices less than the nozzles ones (Does filter mesh correspond to nozzle)?				
7.1a	Are all nozzles fitted in the lance in good condition?				
7.1b	Are all nozzle bodies in good condition?				
7.2	Is the shape of the spray jet regular (uniform shape, homogeneous spray)?				
8.1	Is the sprayer lever-operated AND is lever in good condition?				
B.	**Engine-driven sprayers**				
9.1	Is it possible to empty the spray tank without having to invert the engine (without turning the sprayer upside down)?				
9.2	Is there pressure safety valve present AND does it work properly (prevents pressurisation of the sprayer beyond the maximum working pressure)?				
9.3	Are there the power-driven components guarded (pulleys, shafts, gears, flywheels, drive belts and chains) AND are that guards in good condition?				
9.4	Has the fuel cap a retainer, and does fuel tank have a ventilation system present AND does it work properly?				
9.5	Are there the covers of hot elements (engine, silencer) present?				
9.6	Are the exhaust outlets located and directed safely for the operator?				
9.7	Are the parts of the engine being under a high voltage insulated to avoid contact with operator?				
9.8a	Are there the blower and air guide plates present and are complete AND work properly?				
9.8b	Is it possible to control the engine AND is the engine speed stable?				



Checklist questions

- Inspired by two standards:
  - ISO/CD 19932-3 (under development)
  - ISO 19932-2:2013 (published)
- Types of questions in the procedure:
  - on (device) presence AND condition-functioning
  - concerning sprayer type groups
  - **arbitrary** divided in two groups:
    - questions that all should be answered positively in 100%
    - questions that may be answered positively in 80%

The protocol of self-inspection

- Two-page A4 document.
- The introduction part contains owner and diagnostician information as well as sprayer data.
- Main protocol parts for:
  - all types of hand-held and knapsack sprayers
  - additional checks for engine-driven sprayers
  - additional checks for electric motor–driven sprayers
  - additional checks for compression sprayers
- Two supplementary and informative parts:
  - on nozzles flowrate measurement
  - on how to use the protocol (range of inspection for different types of sprayers, the importance of questions)

PROTOCOL OF SELF-INSPECTION OF HAND-HELD OR KNAPSACK SPRAYER

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B.	**Engine-driven sprayers**				
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9.2	Is there pressure safety valve present AND does it work properly (prevents pressurisation of the sprayer beyond the maximum working pressure)?				
9.3	Are there the power-driven components guarded (pulleys, shafts, gears, flywheels, drive belts and chains) AND are that guards in good condition?				
9.4	Has the fuel cap a retainer, and does fuel tank have a ventilation system present AND does it work properly?				
9.5	Are there the covers of hot elements (engine, silencer) present?				
9.6	Are the exhaust outlets located and directed safely for the operator?				
9.7	Are the parts of the engine being under a high voltage insulated to avoid contact with operator?				
9.8a	Are there the blower and air guide plates present and are complete AND work properly?				
9.8b	Is it possible to control the engine AND is the engine speed stable?				

No.	Question	Present	Not	Yes	No
C.	**Electric motor–driven sprayers**				
10.1	Are there the power-driven components guarded (power transmission to pump and/or blower) AND are they in a good condition?				
10.2	Are the electric elements of the motor properly insulated and fixed?				
D.	**Compression sprayers**				
11.1	Is there a pressure safety valve present AND does it work properly?				
11.2	Is it possible to get and keep the pressure in the tank of compression sprayer?				
E.	**Supplementary information: Nozzle/s output**				
7.4	Has the spraying lance more than one nozzle AND is the output of equivalent nozzles equal?				

Recommended maximum nozzle output deviation from mean nozzle output for equivalent nozzles ≤15%

Nozzle	1.	2.	3.	4.	5.	6.	7.	8.
Measured output (l/min):								
Mean output (l/min):								
Deviation (l/min):								
Deviation ≤15%: (Y/N)								

7.5	Is the nozzle output repeatable for 3 measurements done in the same conditions of sprayer work and for the same nozzles or restrictors fitted on?								

Recommended deviation from the mean for 3 measurements for same conditions and nozzles/restrictors ≤15%

Setting / conditions	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Output (l/min) – trial 1								
Output (l/min) – trial 2								
Output (l/min) – trial 3								
Mean output (l/min):								
Max deviation (l/min):								
Deviation ≤15%: (Y/N)								

The scope of the inspection depending on sprayer type:

Sprayer type	Required				Supplementary
	A	B	C	D	E
All	x				x
Engine-driven	x	x			x
Electric motor-driven	x		x		x
Compression	x			x	x

In parts A-D red colour marked text means requirement of 100% of positive answers. For other questions at least 80% of positive answer is acceptable. In Part E, one may use the output measurement data from sprayer calibration.

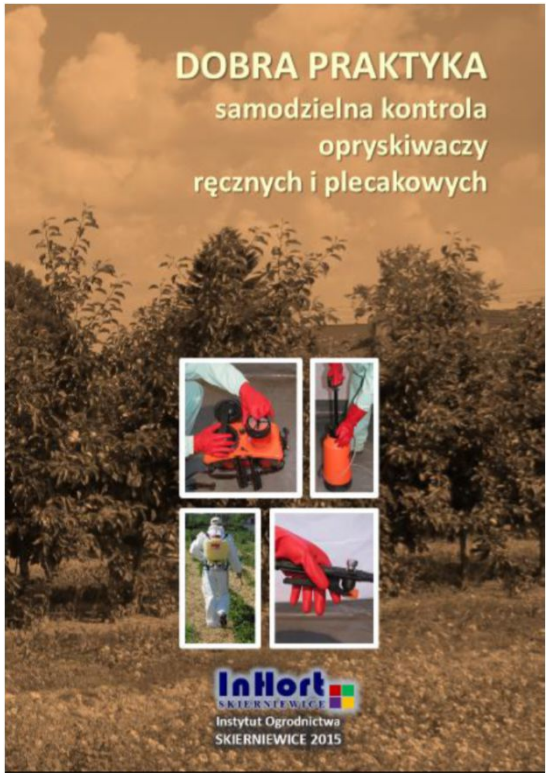
Final comments and recommendations:

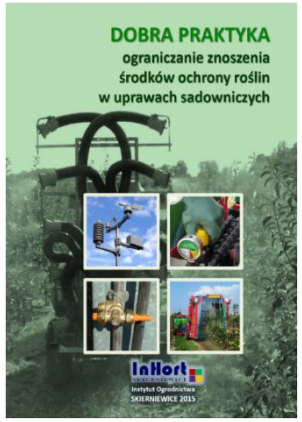
	Self-inspection result: positive (Yes); negative (No) Explanation (if needed):				

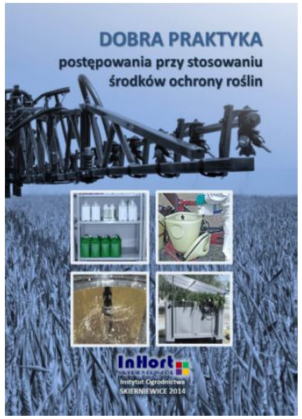
This protocol was elaborated (in Polish) in 2015 year in the frame of Multi-annual Programme "Development of sustainable methods of horticultural production to ensure high biological and nutritional quality of horticultural products and to preserve the biodiversity of the environment and to protect its resources", financed by Polish Ministry of Agriculture and Rural Development.

The brochure

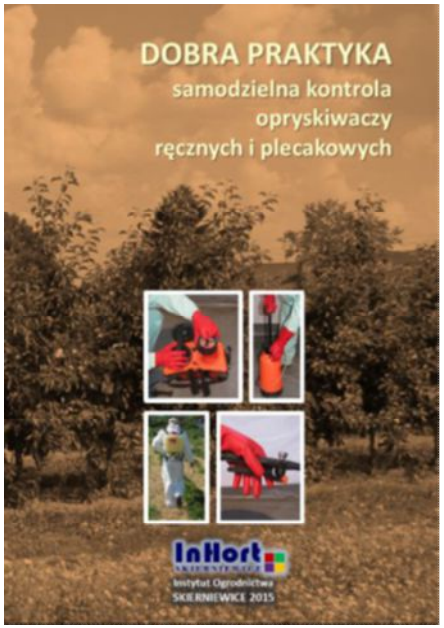
- The 80-page brochure
- Basic information on knapsack sprayers and their professional use
- Relevant legislation and standards,
- The construction, mode of operation
- Frequent faults and basic repairs
- Illustrations and drawings
- Risks for operator and environment during sprayers use
- Information on risk trials (presented at SPISE-4)
- Procedures of self-inspection
- Suggested measuring equipment
- The self-check protocol

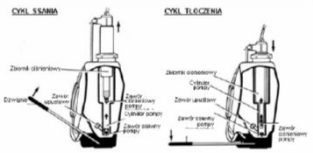






BMP – self-inspection
BMP – drift reduction
BMP – point sources





Rys. 3. Budowa i zasada działania dźwigniowego opryskiwacza plecakowego z pompą tłokową/nurnikową.

Opryskiwacz kompresyjny (ciśnieniowy) (rys. 4)

W opryskiwaczu kompresyjnym (ciśnieniowym) zbiornik cieczy pełni także rolę zbiornika ciśnieniowego. Dlatego zbiornik ten musi mieć odpowiednią wytrzymałość na działanie ciśnienia. Jest on zwykle napełniany cieczą tylko do 2/3 swojej całkowitej objętości. Pozostała 1/3 przeznaczona jest na powietrze, które po sprężeniu stanowi pneumatyczny akumulator. Pozostawienie w zbiorniku mniej miejsca na sprężone powietrze spowoduje, że po rozpoczęciu opryskiwania nastąpi bardzo szybki spadek ciśnienia i redukcja wydatku rozpylacza.

Rys. 4 Budowa i zasad działania kompresyjnego (ciśnieniowego) opryskiwacza ręcznego lub plecakowego.

Rys. 10 Uszczelnienie gniazda filtra w rękojeści lancy opryskiwacza plecakowego.

Rys.11 Uszczelnienie mocowania rozpylacza na lancy.

Rys. 12 Przepona pompy dźwigniowego opryskiwacza plecakowego.

8. Samodzielna kontrola opryskiwaczy ręcznych

WYMAGANIA OGÓLNE

Opryskiwacz nie powinien być pod ciśnieniem, powinien być pusty i czysty na zewnątrz i wewnątrz. Większość wymagań należy sprawdzić wizualnie (rys. 121, 122).

7. Samodzielna kontrola opryskiwaczy plecakowych

Wymagany sprzęt pomiarowy:

1. Wyskalowany pojemnik do pomiaru objętości wody (co najmniej 1,0 l z podziałką co 10 ml).
2. Wiaderko o pojemności 5-10 l oraz wodoodporne przykrycie z otworem na lancę opryskiwacza (ok. ø 40 mm).
3. Materiał do wycierania opryskiwacza do sucha (przed testami szczelności): nasiąkliwa tkanina, włóknina, ręczniki papierowe.
4. Miarka/linijka o długości co najmniej 100 mm i dokładności pomiaru ± 0,5 mm.

WYMAGANIA OGÓLNE

Opryskiwacz nie powinien być pod ciśnieniem, powinien być pusty i czysty na zewnątrz i wewnątrz. Większość wymagań należy sprawdzić wizualnie (rys. 18-21).

URZĄDZENIA KONTROLNO-POMIAROWE

1. Czy opryskiwacz jest wyposażony w zawór odcinający?

- należy sprawdzić dla opryskiwacza napełnionego czysta wodą „pod maksymalnym roboczym ciśnieniem", czy zawór odcina wypływ cieczy natychmiast po naciśnięciu i czy nie następują wycieki cieczy z zaworu (rys. 67, 68).

2. Czy kształt strumienia wypryskiwanej cieczy jest prawidłowy (zgodny z wskazaniami producenta opryskiwacza lub rozpylaczy)?

- stosując czystą wodę należy ocenić wizualnie kształt strumienia i równomierność śladu cieczy na opryskiwanej powierzchni przy standardowym ciśnieniu roboczym (maksymalnym zalecanym przez producenta lub zwykle stosowanym przez operatora opryskiwacza). W przypadku braku ciśnieniomierza na opryskiwaczu należy zachować zwykle stosowane ustawienia i parametry wykonywanych czynności (np. częstotliwość ruchów dźwignią) w celu zachowania stałego ciśnienia. Ocenę równomierności śladu cieczy wypryskiwanej na utwardzoną powierzchnię (beton, asfalt, kostka brukowa lub betonowa, ubita gleba) należy przeprowadzić przy zachowaniu stałej pozycji lancy (skierowanie i wysokość) i prędkości marszu (rys. 81-85).

Conclusions

- For PAE excluded from the official inspection, the training materials availability for growers and trainers is demanded.
- The training materials should contain inspection procedure which may be carried out by the grower himself.
- The procedure have to be simple question checklist.
- In case of the equipment certificate needed (eg. in GAP, IPM, certificated production) that procedure may be documented by grower himself in the protocol.
- The illustrated brochure containing the basis information on the equipment, and self-inspection procedure may be used by trainers and applicators themselves.

A mandatory inspection - every 3 or 5 years

- … so self-inspect your PAE between inspections
- Use only calibration equipment
- Do full procedure in the beginning of the seson
- Do short procedures before each sprayer use

Literature

ISO/CD 19932-3 - Equipment for crop protection — Knapsack sprayers — Part 3: Inspection of knapsack sprayers in use.

ISO 19932-2:2013 - Equipment for crop protection — Knapsack sprayers — Part 2: Test methods.

SUD directive - Directive 2009/128/EC of the European Parliament and the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides.

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… thank you