

Technical Committee

TC/58/24

Fifty-Eighth Session
Geneva, October 24 and 25, 2022Original: English
Date: October 4, 2022**PARTIAL REVISION OF THE TEST GUIDELINES FOR SPINACH***Document prepared by an expert from the Netherlands**Disclaimer: this document does not represent UPOV policies or guidance*

1. The purpose of this document is to present a proposal for a partial revision of the Test Guidelines for Spinach (document TG/55/7 Rev. 6).

2. The Technical Working Party for Vegetables (TWV), at its fifty-sixth session¹, considered a proposal for a partial revision of the Test Guidelines for Spinach (*Spinacea oleracea* L.) on the basis of documents TG/162/4 and TWV/56/7 "Partial revision of the Test Guidelines for Spinach" and proposed the following changes (see document TWV/56/22 "Report", paragraph 93):

- (a) Change of the name of Char. 18 from "*Peronospora farinosa* f. sp. *spinaciae* (Pfs)" to "*Peronospora effusa* (Pe) (ex *Peronospora farinosa* f. sp. *spinaciae*)" and change of the name of the races from "Race Pfs:(space)'race number'" to "Race Pe (ex Pfs):(space)'race number'"
- (b) Addition of two new races to Characteristic 18:
 - Characteristic 18.17: "Resistance to *Peronospora effusa* (Pe) (ex *Peronospora farinosa* f. sp. *spinaciae*) - Race Pe (ex Pfs): 18";
 - Characteristic 18.18: "Resistance to *Peronospora effusa* (Pe) (ex *Peronospora farinosa* f. sp. *spinaciae*) - Race Pe (ex Pfs): 19".
- (c) Revision of explanation Ad. 18 in Chapter 8.2 "Explanations for individual characteristics"
- (d) Update of Characteristic 18 in Chapter 10 "Technical Questionnaire" and moving information related to Characteristic 18 from Section TQ 7.3 "Other information" to Section TQ 5 "Characteristics of the variety to be indicated"

3. The proposed changes are presented below in highlight and underline (insertion) and ~~striketrough~~ (deletion).

¹ organized by electronic means, from April 18 to 22, 2022

Proposal to change the header of Char. 18 from "*Peronospora farinosa* f. sp. *spinaciae* (Pfs)" to "*Peronospora effusa* (Pe) (ex *Peronospora farinosa* f. sp. *spinaciae*)" and change of the name of the Races from "Race Pfs:(space)'race number'" to "Race Pe (ex Pfs):(space)'race number'"

	English	français	Deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
18. VG (+)	Resistance to <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i> (Pfs) <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)	Résistance à <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i> (Pfs) <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)	Resistenz gegen <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i> (Pfs) <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)	Resistencia a <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i> (Pfs) <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
18.1	Race Pfs Pe (ex Pfs): 1	Race Pfs Pe (ex Pfs): 1	Pathotyp Pfs Pe (ex Pfs): 1	Raza Pfs Pe (ex Pfs): 1		
QL	absent	absente	fehlend	ausente	Viroflay, Winterreuzen	1
	present	présente	vorhanden	presente	Califlay, Resistoflay	9
18.2	Race Pfs Pe (ex Pfs): 2	Race Pfs Pe (ex Pfs): 2	Pathotyp Pfs Pe (ex Pfs): 2	Raza Pfs Pe (ex Pfs): 2		
QL	absent	absente	fehlend	ausente	Califlay	1
	present	présente	vorhanden	presente	Resistoflay	9
18.3	Race Pfs Pe (ex Pfs): 3	Race Pfs Pe (ex Pfs): 3	Pathotyp Pfs Pe (ex Pfs): 3	Raza Pfs Pe (ex Pfs): 3		
QL	absent	absente	fehlend	ausente	Resistoflay	1
	present	présente	vorhanden	presente	Califlay, Clermont	9
18.4	Race Pfs Pe (ex Pfs): 4	Race Pfs Pe (ex Pfs): 4	Pathotyp Pfs Pe (ex Pfs): 4	Raza Pfs Pe (ex Pfs): 4		
QL	absent	absente	fehlend	ausente	Califlay	1
	present	présente	vorhanden	presente	Clermont	9
18.5	Race Pfs Pe (ex Pfs): 5	Race Pfs Pe (ex Pfs): 5	Pathotyp Pfs Pe (ex Pfs): 5	Raza Pfs Pe (ex Pfs): 5		
QL	absent	absente	fehlend	ausente	Clermont	1
	present	présente	vorhanden	presente	Califlay, Campania	9
18.6	Race Pfs Pe (ex Pfs): 6	Race Pfs Pe (ex Pfs): 6	Pathotyp Pfs Pe (ex Pfs): 6	Raza Pfs Pe (ex Pfs): 6		
QL	absent	absente	fehlend	ausente	Califlay, Campania	1
	present	présente	vorhanden	presente	Boeing	9

	English	français	Deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
18.7	Race Pfs Pe (ex Pfs): 7	Race Pfs Pe (ex Pfs): 7	Pathotyp Pfs Pe (ex Pfs): 7	Raza Pfs Pe (ex Pfs): 7		
QL	absent	absente	fehlend	ausente	Califlay	1
	present	présente	vorhanden	presente	Campania	9

18.8	Race Pfs Pe (ex Pfs): 8	Race Pfs Pe (ex Pfs): 8	Pathotyp Pfs Pe (ex Pfs): 8	Raza Pfs Pe (ex Pfs): 8		
QL	absent	absente	fehlend	ausente	Boeing, Campania	1
	present	présente	vorhanden	presente	Lazio, Lion	9

18.9	Race Pfs Pe (ex Pfs): 10	Race Pfs Pe (ex Pfs): 10	Pathotyp Pfs Pe (ex Pfs): 10	Raza Pfs Pe (ex Pfs): 10		
QL	absent	absente	fehlend	ausente	Boeing, Campania, Lion	1
	present	présente	vorhanden	presente	Lazio	9

18.10	Race Pfs Pe (ex Pfs): 11	Race Pfs Pe (ex Pfs): 11	Pathotyp Pfs Pe (ex Pfs): 11	Raza Pfs Pe (ex Pfs): 11		
QL	absent	absente	fehlend	ausente	Lazio	1
	present	présente	vorhanden	presente	Boeing, Califlay, Campania, Lion	9

18.11	Race Pfs Pe (ex Pfs): 12	Race Pfs Pe (ex Pfs): 12	Pathotyp Pfs Pe (ex Pfs): 12	Raza Pfs Pe (ex Pfs): 12		
QL	absent	absente	fehlend	ausente	Boeing, Campania	1
	present	présente	vorhanden	presente	Finch, Pigeon, Red Kitten, Zebu	9

18.12	Race Pfs Pe (ex Pfs): 13	Race Pfs Pe (ex Pfs): 13	Pathotyp Pfs Pe (ex Pfs): 13	Raza Pfs Pe (ex Pfs): 13		
QL	absent	absente	fehlend	ausente	Campania	1
	present	présente	vorhanden	presente	Boeing, Lion	9

18.13	Race Pfs Pe (ex Pfs): 14	Race Pfs Pe (ex Pfs): 14	Pathotyp Pfs Pe (ex Pfs): 14	Raza Pfs Pe (ex Pfs): 14		
QL	absent	absente	fehlend	ausente	Campania, Pigeon	1
	present	présente	vorhanden	presente	Califlay, Lion	9

18.14	Race Pfs Pe (ex Pfs): 15	Race Pfs Pe (ex Pfs): 15	Pathotyp Pfs Pe (ex Pfs): 15	Raza Pfs Pe (ex Pfs): 15		
QL	absent	absente	fehlend	ausente	Caladonia	1
	present	présente	vorhanden	presente	Pigeon	9

	English	français	Deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
18.15	Race Pfs Pe (ex Pfs): 16	Race Pfs Pe (ex Pfs): 16	Pathotyp Pfs Pe (ex Pfs): 16	Raza Pfs Pe (ex Pfs): 16		
QL	absent	absente	fehlend	ausente	Meerkat	1
	present	présente	vorhanden	presente	Caladonia	9
18.16	Race Pfs Pe (ex Pfs): 17	Race Pfs Pe (ex Pfs): 17	Pathotyp Pfs Pe (ex Pfs): 17	Raza Pfs Pe (ex Pfs): 17		
QL	absent	absente	fehlend	ausente	Pigeon	1
	present	présente	vorhanden	presente	Hydrus	9

Proposal to add new races "Pe (ex Pfs): 18" and "Pe (ex Pfs): 19"

18.17	Race Pe (ex Pfs): 18	Race Pe (ex Pfs): 18	Pathotyp Pe (ex Pfs): 18	Raza Pe (ex Pfs): 18		
QL	absent	absente	fehlend	ausente	Caladonia, Meerkat	1
	present	présente	vorhanden	presente	Hydrus	9
18.18	Race Pe (ex Pfs): 19	Race Pe (ex Pfs): 19	Pathotyp Pe (ex Pfs): 19	Raza Pe (ex Pfs): 19		
QL	absent	absente	fehlend	ausente	Hydrus, Meerkat	1
	present	présente	vorhanden	presente	Caladonia	9

Revision of explanation Ad. 18 in Chapter 8.2 "Explanations for individual characteristics"

Ad. 18: Resistance to ~~*Peronospora farinosa* f. sp. *Spinaciae*~~ *Peronospora effusa* (Pe) (ex *Peronospora farinosa* f. sp. *spinaciae*)

Maintenance of races

Type of medium: Living host plants, obtainable from:
 Naktuinbouw
 P.O. Box 40
 NL-2370 AA Roelofarendsveen
 Netherlands
 www.naktuinbouw.com
 or plant material with spores stored at -20° C for a maximum of one year

Execution of test

Growth stage of plants: First cotyledons/leaf, eleven-day-old plants

Temperature: 15°C during day/12°C during night

Light: 15 hours per day, after emergence

Growing method: In soil in pots or trays in a glasshouse or growth chamber

Method of inoculation: Sporulating leaves, taken from host plants that were infected seven days before, are thoroughly rinsed with sterile tap water (maximum 150 ml water per 224 plants). The spore suspension is filtered through cheesecloth and sprayed on test plants until the inoculum covers the leaves but does not run off. 150 ml of suspension is enough for up to 3 x 224 plants. Spore density should be 20,000 to 100,000 conidia/ml water. The spore suspension should be used fresh.

Remarks: Spinach downy mildew is wind-borne. Sporulating plants should be kept in closed containers or isolated chambers to prevent any cross-contamination. Resistant controls are needed in each multiplication and in each test to ensure the race identity.

Light and humidity conditions during seedling development and incubation are critical. Optimal humidity of approximately 80-90% RH allows plant growth and fungal growth; strong light inhibits spore germination and infection.

The test should be carried out in wintertime with protection against direct sunshine. After inoculation, the plants should remain under plastic for three days. After this time, the plastic should be slightly raised during the daytime.

Duration of test

- Multiplication harvest spores 7 days after inoculation
 - Sowing to inoculation: 11 days
 - Inoculation to reading: 10 days

Number of plants tested at least 20 plants

Evaluation of infection: Resistance is usually complete; sometimes necrotic spots are visible as a result of infection. Some varieties may have a slightly lower level of

resistance, showing for example a slight tip sporulation. In the table this is/these varieties are indicated by (R).

Susceptible plants show varying degrees of sporulation. Sporulation is visible as a grey covering on leaves, starting on the more humid abaxial side.

Disease resistance reactions of spinach downy mildew races on differentials of the International Working Group on *Peronospora* (IWGP)

Races Pfs Pe (ex Pfs): 1-8 and 10-17 19 of *Peronospora farinosa* f. sp. *spinaciae* *Peronospora effusa* (Pe) (ex *Peronospora farinosa* f. sp. *spinaciae*) are defined with a standard set of differentials according to the following table:

Differentials and isolates are available at Naktuinbouw:

Naktuinbouw
P.O. Box 40
NL-2370 AA Roelofarendsveen
Netherlands
www.naktuinbouw.com

Race – Pfs:																
Differentials	1	2	3	4	5	6	7	8	10	11	12	13	14	15	16	17
Viroflay	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
NIL 5	R	R	S	S	S	S	S	S	S	S	S	S	S	S	S	S
NIL 3	R	S	R	S	R	S	S	R	S	R	R	S	R	S	R	S
NIL 4	R	R	R	R	S	S	S	S	S	S	S	S	S	R	S	S
NIL 6	R	S	R	R	R	S	R	S	S	R	S	(R)	S	R	R	S
NIL 1	R	R	R	R	R	R	R	S	S	R	S	R	S	R	R	S
Whale	R	R	R	(R)	R	(R)	(R)	R	(R)	R	R	S	R	(R)	R	S
Pigeon	R	R	R	R	R	R	R	R	R	R	R	R	S	R	S	S
Caladonia	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	S
Meerkat	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S	(R)
Hydrus	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

Reaction patterns of <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>) races on the IWGP spinach differential set																		
Race Pe (ex Pfs):																		
Differentials with ranking order	1	2	3	4	5	6	7	8	10	11	12	13	14	15	16	17	18	19
<u>V</u> Viroflay	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
<u>1</u> NIL 5	R	R	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
<u>2</u> NIL 3	R	S	R	S	R	S	S	R	S	R	R	S	R	S	R	S	S	R
<u>3</u> NIL 4	R	R	R	R	S	S	S	S	S	S	S	S	S	R	S	S	S	S
<u>4</u> NIL 6	R	S	R	R	R	S	R	S	S	R	S	(R)	S	R	R	S	R	S
<u>5</u> NIL 1	R	R	R	R	R	R	R	S	S	R	S	R	S	R	R	S	R	S
<u>6</u> NIL 2	R	R	R	R	R	R	R	R	R	S	S	S	S	R	S	S	S	S
<u>7</u> Pigeon	R	R	R	R	R	R	R	R	R	R	R	R	S	R	S	S	S	S
<u>8</u> Caladonia	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	S	S	R
<u>9</u> Meerkat	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S	(R)	S	S
<u>10</u> Hydrus	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S

Legend: S = susceptible, R or (R) = resistant

(Courtesy of ISF, table available under <http://www.worldseed.org>)

Update of Characteristic 18 in Chapter 10 “Technical Questionnaire” and moving information related to Characteristic 18 from Section TQ 7.3 “Other information” to Section TQ 5 “Characteristics of the variety to be indicated

Proposed removal of Characteristic 18 from Section TQ 7.3 “Other information”

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#7. Additional information which may help in the examination of the variety

[...]

7.3 Other information

(a) Variety use:

- only in glasshouse []
- only in the open []
- in the open and in glasshouse []

(b) Resistance to pests and diseases (specify)

(i) ~~Resistance to *Peronospora farinosa* f. sp. *spinaciae*~~

Race Pfs: 1	[] absent	[] present	[] not tested
Race Pfs: 2	[] absent	[] present	[] not tested
Race Pfs: 3	[] absent	[] present	[] not tested
Race Pfs: 4	[] absent	[] present	[] not tested
Race Pfs: 5	[] absent	[] present	[] not tested
Race Pfs: 6	[] absent	[] present	[] not tested
Race Pfs: 7	[] absent	[] present	[] not tested
Race Pfs: 8	[] absent	[] present	[] not tested
Race Pfs: 10	[] absent	[] present	[] not tested
Race Pfs: 11	[] absent	[] present	[] not tested
Race Pfs: 12	[] absent	[] present	[] not tested
Race Pfs: 13	[] absent	[] present	[] not tested
Race Pfs: 14	[] absent	[] present	[] not tested
Race Pfs: 15	[] absent	[] present	[] not tested
Race Pfs: 16	[] absent	[] present	[] not tested
Race Pfs: 17	[] absent	[] present	[] not tested

[...]

Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire.

Proposed addition of Characteristic 18 to Section TQ 5 "Characteristics of the variety to be indicated"

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:
Characteristics	Example Varieties	Note
[...]		
(18.1) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 1		
absent	Viroflay, Winterreuzen	1 <input type="checkbox"/>
present	Califlay, Resistoflay	9 <input type="checkbox"/>
not tested		<input type="checkbox"/>
(18.2) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 2		
absent	Califlay	1 <input type="checkbox"/>
present	Resistoflay	9 <input type="checkbox"/>
not tested		<input type="checkbox"/>
(18.3) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 3		
absent	Resistoflay	1 <input type="checkbox"/>
present	Califlay, Clermont	9 <input type="checkbox"/>
not tested		<input type="checkbox"/>
(18.4) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 4		
absent	Califlay	1 <input type="checkbox"/>
present	Clermont	9 <input type="checkbox"/>
not tested		<input type="checkbox"/>
(18.5) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 5		
absent	Clermont	1 <input type="checkbox"/>
present	Califlay, Campania	9 <input type="checkbox"/>
not tested		<input type="checkbox"/>

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:
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Characteristics	Example Varieties	Note
(18.6) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 6		
absent	Califlay, Campania	1f]
present	Boeing	9f]
not tested]
(18.7) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 7		
absent	Califlay	1f]
present	Campania	9f]
not tested]
(18.8) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 8		
absent	Boeing, Campania	1f]
present	Lazio, Lion	9f]
not tested]
(18.9) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 10		
absent	Boeing, Campania, Lion	1f]
present	Lazio	9f]
not tested]
(18.10) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 11		
absent	Lazio	1f]
present	Boeing, Califlay, Campania, Lion	9f]
not tested]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:
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Characteristics	Example Varieties	Note
(18.11) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 12		
absent	Boeing, Campania	1f <input type="checkbox"/>
present	Finch, Pigeon, Red Kitten, Zebu	9f <input type="checkbox"/>
not tested		<input type="checkbox"/>
(18.12) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 13		
absent	Campania	1f <input type="checkbox"/>
present	Boeing, Lion	9f <input type="checkbox"/>
not tested		<input type="checkbox"/>
(18.13) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 14		
absent	Campania, Pigeon	1f <input type="checkbox"/>
present	Califlay, Lion	9f <input type="checkbox"/>
not tested		<input type="checkbox"/>
(18.14) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 15		
absent	Caladonia	1f <input type="checkbox"/>
present	Pigeon	9f <input type="checkbox"/>
not tested		<input type="checkbox"/>
(18.15) Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)		
Race Pe (ex Pfs): 16		
absent	Meerkat	1f <input type="checkbox"/>
present	Caladonia	9f <input type="checkbox"/>
not tested		<input type="checkbox"/>

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:
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Characteristics	Example Varieties	Note
(18.16) <u>Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)</u>		
<u>Race Pe (ex Pfs): 17</u>		
<u>absent</u>	<u>Pigeon</u>	<u>1</u> <input type="checkbox"/>
<u>present</u>	<u>Hydrus</u>	<u>9</u> <input type="checkbox"/>
<u>not tested</u>		<input type="checkbox"/>
(18.17) <u>Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)</u>		
<u>Race Pe (ex Pfs): 18</u>		
<u>absent</u>	<u>Caladonia, Meerkat</u>	<u>1</u> <input type="checkbox"/>
<u>present</u>	<u>Hydrus</u>	<u>9</u> <input type="checkbox"/>
<u>not tested</u>		<input type="checkbox"/>
(18.18) <u>Resistance to <i>Peronospora effusa</i> (Pe) (ex <i>Peronospora farinosa</i> f. sp. <i>spinaciae</i>)</u>		
<u>Race Pe (ex Pfs): 19</u>		
<u>absent</u>	<u>Hydrus, Meerkat</u>	<u>1</u> <input type="checkbox"/>
<u>present</u>	<u>Caladonia</u>	<u>9</u> <input type="checkbox"/>
<u>not tested</u>		<input type="checkbox"/>
[...]		

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