

Let's discover the enemy



Clubroot

Plasmodiophora brassicae (Pb)

A persistent presence thanks to a specific life cycle

Clubroot, caused by *Plasmodiophora brassicae*, is considered one of the most destructive diseases of cultivated crucifers. Affected roots swell into club shaped, tumor-like galls that interfere with water uptake resulting in severe stunted growth of the plant. The pathogen survives in the soil for up to 15 years in the form of resting spores released from decayed galls. Optimum temperatures for disease development are 20-25° C. High soil moisture content and acidic pH (<7) also favour disease development. Normally the disease is visible as patches in the field, but also complete fields can be infected. The pathogen spreads through infected soil particles on equipment, shoes etc.

Existing ways of control

Cultural measures as regular attention to soil drainage and liming are often recommended but normally have only a partial effect. Fertilization with nitrogen in the form of calcium nitrate or calcium cyanamide also helps through maintaining alkaline soil pH. Chemical control remains time consuming and is not very effective and is not allowed in all countries.

New highly resistant varieties have proven to be a reliable innovation

The best way to combat clubroot is through breeding of resistant varieties. Until 2004, resistant varieties in Brassica crops were only present in Chinese cabbage, oriental radish, turnips and oilseed. A high level of resistance in cole crops (*Brassica oleracea*) like cabbage, Brussels sprouts and cauliflower was not present.

In 2004 Syngenta Seeds, S&G brand, succeeded, after nearly 18 years of classical breeding, to introduce an equal level of resistance in varieties of cabbage, Brussels sprouts and cauliflower compared to e.g. Chinese cabbage.

Growers confirm the added value of S&G's highly resistant varieties.

"We can grow cabbage anywhere"

"Resistant varieties guarantee our income"

"When in doubt, I choose for resistant varieties of S&G for a reliable harvest"



These are the findings of growers who decided to grow clubroot resistant varieties. These growers are from Belgium, Finland and The Netherlands and they have been interviewed about their production and marketing experience.

Major benefits of using clubroot resistant varieties

The use of these clubroot resistant varieties offers many advantages and benefits to white cabbage and cauliflower growers:

- it gives the grower an additional agronomical security in the field;
- it makes planning more simple and market deliveries more reliable;
- it allows growers to come back and re-crop infested areas;
- high yielding varieties;
- these resistant varieties are playing a key role in the Integrated Crop Management of white cabbage and cauliflower, as more and more often required by retailers.

By choosing these innovative clubroot resistant varieties, growers will get a high economical benefit and will make the best use of their production area and more specifically of their field's potential (soil and climate).



Resistance

Resistance is the ability of a plant variety to restrict the growth and development of a specified pest or pathogen and/or the damage they cause when compared to susceptible plant varieties under similar environmental conditions and pest or pathogen pressure. Resistant varieties may exhibit some disease symptoms or damage under heavy pest or pathogen pressure.

2 levels of resistance are defined

High/standard resistance (HR):

plant varieties that highly restrict the growth and development of the specified pest or pathogen under normal pest or pathogen pressure when compared to susceptible varieties. These plant varieties may, however, exhibit some symptoms or damage under heavy pest or pathogen pressure.

Moderate/intermediate resistance (IR):

plant varieties that restrict the growth and development of the specified pest or pathogen, but may exhibit a greater range of symptoms or damage compared to resistant varieties. Moderately/intermediately resistant plant varieties will still show less severe symptoms or damage than susceptible plant varieties when grown under similar environmental conditions and/or pest or pathogen pressure

Susceptibility

Susceptibility is the inability of a plant variety to restrict the growth and development of a specified pest or pathogen.

Syngenta Seeds has exercised reasonable care and skill in compiling this brochure.

Resistance against clubroot is effective against the predominant strains but not against infrequent strains that may occur in some fields in Europe and that may break the resistance. At present very sparse information is available on the type of strains and their occurrence. Separation and identification of the different strains is also technically difficult.

It is advised to first execute small trials before starting commercial production.

In order to maximize the efficiency of a resistance, it is highly recommended to mix different ways of control such as growing conditions (for clubroot culture measures as liming, drainage, Calcium fertilization), plant protection products and genetic resistance as part of an integrated crop management. All data in this brochure are intended for general guidance only and the user should apply it in accordance with his knowledge and experience of local conditions. In case of doubt we recommend that a small scale trial production be carried out to determine how local conditions may affect the variety.



Passion for innovation

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Brassica 2007
S&G



**CLUBROOT
RESISTANCE**



White cabbage, cauliflower
Ensure a reliable harvest



What occurs underground
can cause **serious visible
damage** above soil level !

Tekila

Kilaton

Kilaxy

Kilazol

Kilaherb

Clapton

Clarify...

Brassica



Passion for innovation



White cabbage

Tekila Tekila (SG3291)

Fresh market cabbage

Growers

Advantages

- Cabbage for the fresh market
- Growing reliability due to both Fusarium and clubroot resistance
- Long field standing ability
- Round shape
- Flexible size (0,8-2,5 kg) depending on plant density
- Good internal structure
- High uniformity (CMS)



Kilaton Kilaton (SG3320)

High yielding, long storable cabbage Fresh Market & Industry

Growers Processors

Advantages

- Very long storable variety
- Growing reliability due to its clubroot resistance
- Storage reliability due to its tolerance against internal black
- Very high yield
- Nice external green colour, even after long storage
- For fresh market or industry purpose depending on plant density (Head weight of 2,5-4 kg)
- High uniformity (CMS)



Kilaxy Kilaxy (SG3325)

Cabbage for long storage Fresh Market

Growers

Advantages

- Long storable variety
- Growing reliability due to its clubroot resistance
- Storage reliability due to its tolerance against internal black
- Size adapted to Fresh market (2-2,5 kg)
- High uniformity (CMS)
- Nice external green colour, even after long storage
- Good internal structure (very thin leaves)



Kilazol Kilazol (SG3319)

NEW 2007

Cabbage for long storage Fresh Market



Growers

Advantages

- Long storable variety
- Growing reliability due to its clubroot resistance
- Adapted for high density 60.000-70.000 plants/ha
- Size adapted for small headed cabbage 0.8-1.5 kg
- High uniformity (CMS)
- Nice external green colour, even after long storage
- Good internal structure (very thin leaves)



Kilaherb Kilaherb (SG3306)

NEW 2007

Fresh Market cabbage

Growers

Advantages

- Cabbage for fresh market
- Growing reliability due to both Fusarium and clubroot resistance
- Strong against thrips
- Long field standing ability
- Round shape
- Flexible size (1.5-4.0 kg) depending on plant density
- Good internal structure
- High uniformity (CMS)

Assortment table white cabbage

VARIETY	Growing days	Kg	Type	Resistances		Thrips ***	Plant vigour	Plant Colour	Storability	Remarks
				Fusarium (Foc 1)*	Clubroot (Ph)**					
Tekila F1	90	2,5	Fresh market	HR	HR	4	6	3	4	Fresh market cabbage. Limited storability
Kilaton F1	140	3-4	Long storage, Fresh market or industry use	-	HR	6	9	9	9	Strong against internal black.
Kilaxy F1	145	2,5-3	Long storage, Fresh market use	-	HR	6	8	8	9	Thin leaves. Strong against internal black.
Kilazol F1	135	0,8-2,5	Long storage, Fresh market use	-	HR	6	8	8	8	Special for high density
Kilaherb F1	100	1,5-4	Fresh market	HR	HR	8	9	5	4	Fresh market cabbage. Limited storability

(***) Sensitivity to Thrips damage: 1- Sensitive 9- Not sensitive

HR = Highly resistant.

(*) Fusarium oxysporum f. sp. conglutinans race 1. Resistance may not work effectively at elevated soil temperature (> 28°C)

(**) Plasmodiophora brassicae. In our white cabbage trials these varieties have proven to be highly resistant to most known Clubroot strains.





Cauliflower

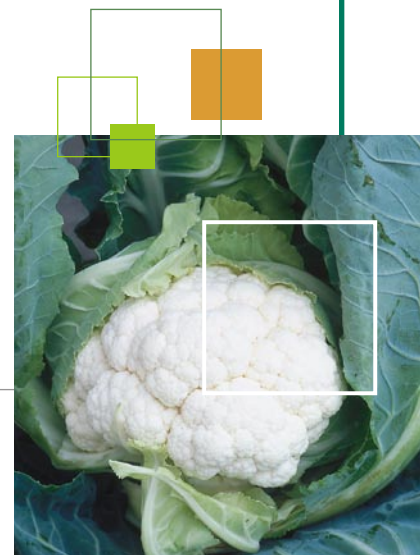
Clapton Clapton (SG5704)

Cauliflower for Fresh Market and Processing Industry

Growers

Advantages

- Heavy and dense curd
- Very good self protection
- Strong against splitting, hairiness and bracting
- Erect plant type



Clarify Clarify (SG5695)

NEW 2007

Cauliflower for Fresh Market and Processing Industry

Growers

Advantages

- Strong vigour
- Heavy and very dense curd
- Earliness
- Nice florets
- Erect plant type
- Reasonably good self protection



Assortment table cauliflower

VARIETY	Growing days	Kg	Type	Resistances	Plant vigour	Curd colour	Self protection	Floret size	Remarks
				Clubroot (Pb)**	9-strong	9-white	9-strong	9-small	
Clapton	70-80	High	Medium long cycle	HR	7	7	8	8	Fresh market and processing industry
Clarify	60-70	Very high	Medium cycle	HR	7	7	6	7	Fresh market and processing industry

HR = Highly resistant.

(**) Plasmodiophora brassicae. In our cauliflower trials these varieties have proven to be highly resistant to most known Clubroot strains.

