INTERNAL BROWN SPOT DEVELOPMENT

by
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Internal brown spot is a physiological disorder which appears as irregular dry, brown or rust colored spots scattered throughout the central portion of tubers. It is becoming more of a problem each year causing several lots of potatoes to be rejected. Many people refer to it as heat necrosis which may be incorrect. According to the literature, heat necrosis is another distinct disorder caused by extremely high soil temperatures. It is characterized by grey to brown necrotic areas located primarily in the area of the vascular ring. Internal brown spot (IBS) also should not be confused with "black spot" which is caused by bruising or brown centers which is incipient hollow heart.

The cause of IBS is not definitely known. Factors which have been implicated are: fluctuating temperatures and moisture and calcium deficiency especially that stimulated by late application of nitrogen.

Experiments conducted at the WSU Othello Experiment Station the past two years indicate that early planted potatoes (Table 1) have significantly higher incidence of IBS.

Table 1. The influence of three planting dates on percent internal brown spot for 1980 and 1981.

PERCENT INTERNAL BROWN SPOT

PLANTING DATE	1980	1981	AV.
March 31	27.7	21.3	24.5
April 20	15.7	15.5	15.6
May 12	4.6	7.0	5.8

The amount decreased linearly with later planted potatoes. What this implies is not definitely known except larger potatoes seem to have a higher incidence than small potatoes within a given lot. However, if tubers from seed of different physiological ages are compared (Table 2) then no significant difference in IBS was obtained.

Table 2. The effect of physiological age of seed as determined by different storage temperatures on percent internal brown spot.

SEED VIGOR

STORAGE TEMPERATURE OF SEED °F.

Year	36	42	48	42-60[1]	60-42[2]
1980	16.7	13.8	17.7	14.7	17.1
1981	17.2	13.7	12.0	13.7	16.5

[1]Stored at 42°F all winter and warmed to 60°F one month before planting.
[2]Stored at 60°F for two months after harvest and then at 42°F until planting.

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Generally seed stored at lower temperatures produce fewer stems per seed piece with fewer tubers set and larger average size at harvest. These results would indicate that large size tubers do not necessarily get internal brown spot. It depends on how the large size was obtained.

The application of Maleic hydrazide at recommended rates of 3 lbs per acre (Table 3) significantly reduced the amount of IBS as compared to the control plots.

Table 3. The influence of Maleic Hydrazide and other chemicals on percent internal brown spot. The MH data is for two years and two application dates in 1981.

PERCENT INTERNAL BROWN SPOT

CHEMICAL TRTS.	1980	1981	AV.
CHECK	8.9	35.8	22.4
MH (July 27)	0	3.3	1.7
MH (Aug. 12)		12.5	
ETHREL		8.3	
$CaCO_3$		18.3	

In 1981 the July application was more effective than the August 12 application. Additional information obtained by R. E. Thronton on commercial fields also indicate that MH 30 is effective in reducing IBS.

Ethrel applied at a rate of 200 ppm on August 12 was also effective in decreasing the incidence of IBS (Table 3). Research conducted in England indiated that calcium applied to nutrient solutions in the greenhouse reduced the amount of IBS. Foliar applications of $CaCO_3$ in the field at Othello (Table 3) appeared to have caused some reduction of IBS. It appears that with rapid growth of tubers, in some cases localized deficiency of calcium can result.

Table 4. The effect of time in storage on percent internal brown spot of check and MH (maleic hydrazide) treated tubers stored at 42°F.

PERCENT INTERNAL BROWN SPOT

TIME IN STORAGE	CHECK	MH
Nov. 2	4.5	0
Dec. 9	8.9	0
Jan. 5	12.4	2.6
Feb. 4	21.7	2.8
March 25	21.1	6.0
April 16	21.1	8.9
May 13	33.3	15.5

Internal brown spot significantly increases in storage. For the check plots the amount increased from 4.5% on November 2 to a high of 33% of the tubers in May (Table 4). Although the MH (maleic hydrazide) treatment caused a significant reduction (from 33 to 15%) it did not completely control the development of this disorder. Internal brown spot incidence was worse in tubers stored at higher temperatures (48 as compared to storage at 42°F) Table 5.

This would be expected since the biochemical and physiological reactions proceed at faster rates with temperature increase. Large tubers had significantly more IBS than small tubers.

Table 5. The influence of storage temperatures (42 and 48°F) and tuber size on percent internal brown spot development.

PERCENT INTERNAL BROWN SPOT

TUBER SIZE	STORAGE TEMPERATURE 42°F	48°F
Small	21.4	36.5
Medium	36.5	56.3
Large	53.9	61.1

The results presented strongly suggest the cause of internal brown spot to be due to uneven and rapid growth rate of tubers occuring in mid to late summer. Growth regulators such as Ethrel and MH appear to alter the growth pattern enough to decrease the incidence. It increases in storage and is probably a continuation of a process initiated before harvest.