



CROP AND SOIL SCIENCES

Weed Management Update

Ramon G. Leon

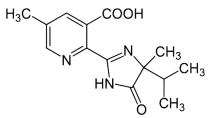
Summary

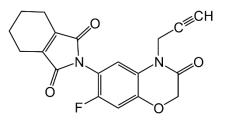
- Herbicide carryover risk
- Herbicide tolerance
- ALS-resistant lines
- Weed risk assessment

Experimental design

Treatments

- Two herbicides:
 - Imazapic (Cadre[®]), flumioxaxine (Valor[®])
- Six application times (Herbicide carryover):
 - 24, 18, 12, 6, 3 and 0 months before planting
- Five doses (Herbicide as preemergent):
 - 1X, 0.5X, 0.25X, 0.125X and 0.068X
- Control without herbicides
- Completely randomized block design
 - 3 x 3 m plot as experimental unit
 - 4 reps each treatment







Soil sampling and greenhouse bioassay

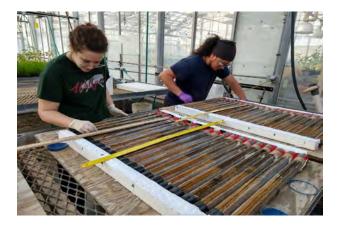
Soil sampling

- Undisturbed soil cores
 - 60 cm depth
 - Two cores per experimental plot
 - Bioassay and residue analysis

Greenhouse bioassay

- Cores placed in a special bench
 - 2 mm depth furrow
 - Carinata seed planted each 2 cm





Soil sampling and greenhouse bioassay

Herbicide residues analysis

- Soil cores
 - Split in 5 cm increments
 - Homogenized
- High performance liquid chromatography-mass spectrometry
 - Agilent-6120 Infinity; Agilent Technologies, Inc., Wilmington, DE
- A rapid resolution high-definition column
 - Agilent ZORBAX RRHD SB-C18; Agilent Technologies, Inc., Wilmington, DE





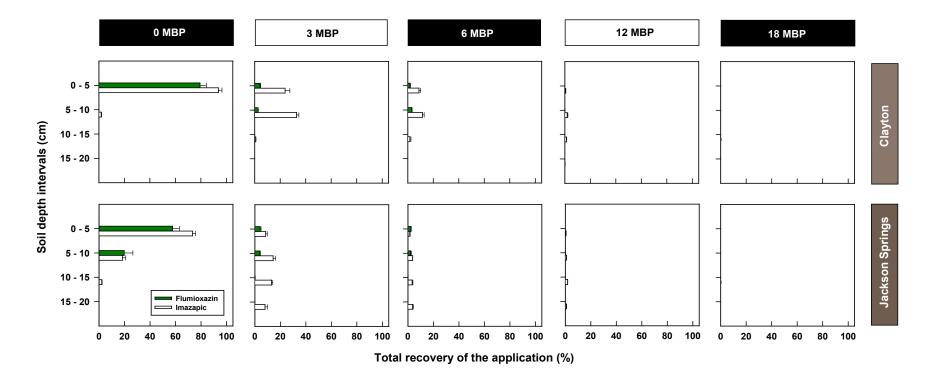
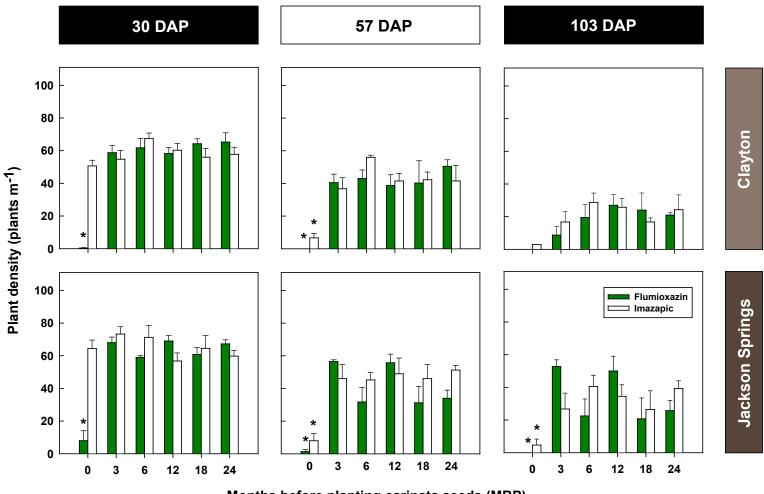


Figure 1 Effect of the herbicide application interval before carinata planting on total recovery of two herbicides in soil from two locations of North Carolina. Imazapic and flumioxazin were applied using recommended label rates of 70 and 107 g ai ha⁻¹, respectively. MBP: Months before planting. Soil sampling depths were increments of 5 cm from 0 to 20 cm. Error bars represent the standard error of the mean (n=3).



Months before planting carinata seeds (MBP)

Figure 2 Carinata population density in response to application interval before planting for two herbicides in *B. carinata* in two locations of North Carolina. The evaluations were done 30, 57, and 103 days after carinata planting (DAP). Error bars represent the standard error of the mean (n=4). * Indicates significant differences with the control without herbicide, according with Dunnett-Test (p-value < 0.05).

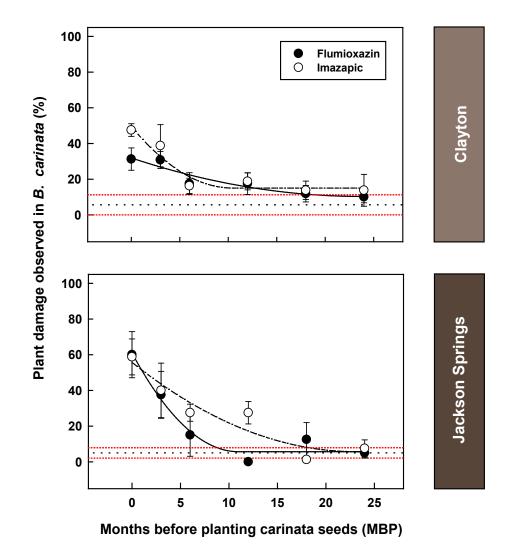


Figure 3 Plant damage at different soil depths in soil cores collected from two locations of North Carolina in response to application interval before carinata planting for two herbicides in *B. carinata*. Black solid and discontinuous lines represent the best-fit model for imazapic and flumioxazin, respectively. Error bars represent the standard error of the mean (n=4). Continuous red lines indicate the average plant damage observed in the control treatment and discontinuous red lines represent standard error.

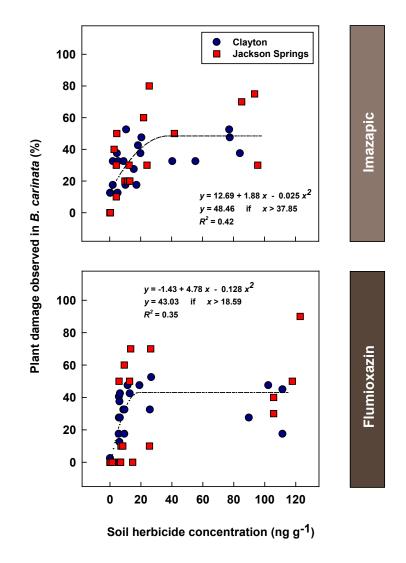
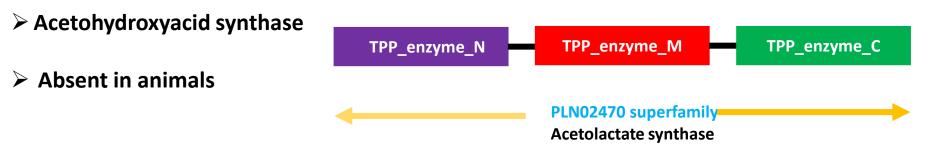


Figure 6 Soil herbicide recovered amount (expressed as concentration) and its effect on carinata plant damage observed in two locations of North Carolina. Black discontinuous lines represent the best-fit model selected for each herbicide.

Acetolactate synthase (ALS) Resistant Lines



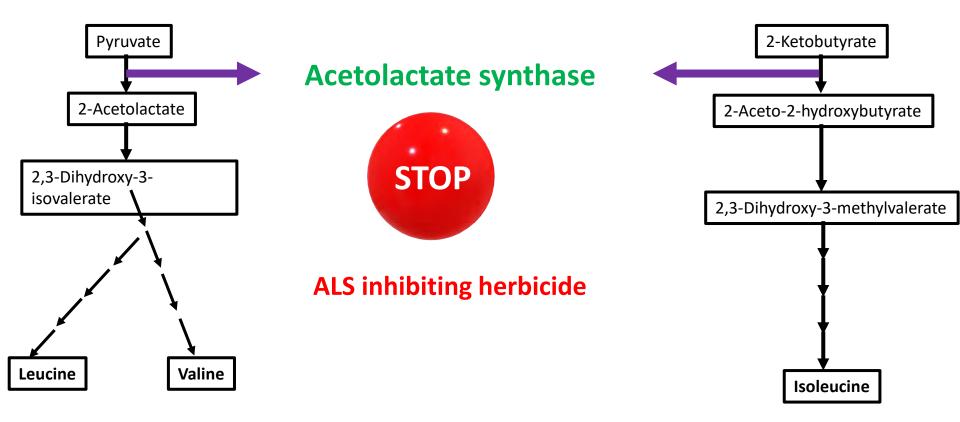
Found in plants and microorganisms

> Condensation of two pyruvate molecules to form acetolactate

> First step in the biosynthesis of branched-chain amino acids

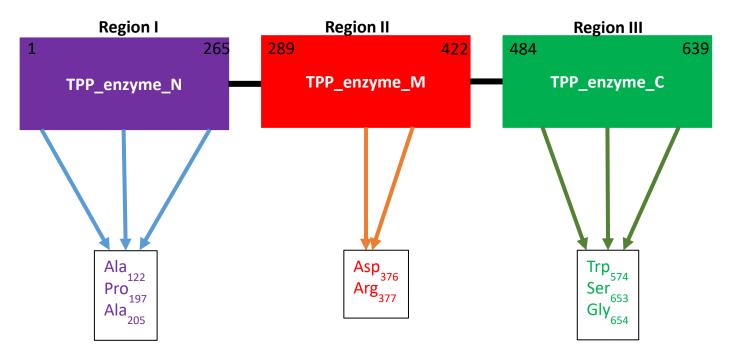
> Important for biosynthesis of amino acid Valine, Leucine and Isoleucine

ALS inhibition



Mutation reported

Over the past 27 years, 29 resistance-endowing amino acid substitutions at eight positions of the ALS gene in 66 weed species have been identified



In Brassica carinata ALS gene was found in two copies one was present in ChrB05 and the another was present on ChrB09

http://www.weedscience.org/mutations/MutationDisplayAll.aspx

Singh et al. Pest Manag Sci. 2019;75:1131-1139

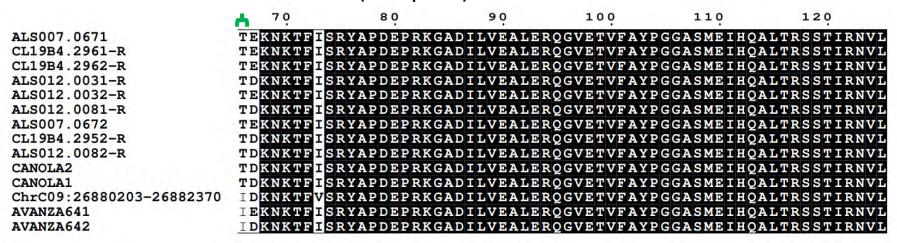
Region I multiple sequence alignment ChrB05

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CL19B4.2962MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS012.0081MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMCL19B4.2951MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMCL19B4.2951MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMCL19B4.2951MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMCL19B4.2951MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMCL19B4.2951MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMCL19B4.2951MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS012.0031MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS012.0031MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS012.0031MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS012.0031MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS012.0031MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS012.0031MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS012.0031MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS012.00311LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.00311LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA6411LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.2952	AVANZA642	1	MEIHOALTRSSTIRNVLPRHEOGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAM
CL19B4.29621MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS012.00811MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMCL19B4.29511MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMCL19B4.29511MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMCL19B4.29511MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMCL19B4.29511MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS012.00311MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS012.00311MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS007.06711MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAMALS012.003261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.067261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPR	ChrB05	1	MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAM
ALS012.00821INITYODURING METHQALTRSSTIRNVLPRHEQGOVFAAEGYARSSGKOGTCIATSGPGATNLVSGLADAN METHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAN METHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAN METHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAN ALS012.0031Canola261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT ALS012.0032Canola161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT ALS012.0032Canola261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT ALS012.0032Canola261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT AVANZA642Canola261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL1984.2962C11984.296261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL1984.2952C11984.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL1984.2952C11984.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL1984.2952C11984.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL1984.2952C11984.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL1984.2951C11984.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL1984.2951C11984.2951	CL19B4.2962	1	MEIHOALTRSSTIRNVLPRHEOGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAM
ALS012.00821MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADANCL19B4.29511MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADANCL19B4.29511MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADANCL19B4.29611MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADANALS012.00311MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADANALS007.06711MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADANALS007.06711MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADANALS012.00311MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADANALS007.06711MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADANALS012.003261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATChrB0561LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQ	ALS012.0081	1	MEIHOALTRSSTIRNVLPRHEOGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAM
CLI984.2951METHQALTRSSTITRVULPRHEQGOVTAAEGYARSSGKPGTCTATSGPGATNLVSGLADANCLI984.2951METHQALTRSSTIRVULPRHEQGGVFAAEGYARSSGKPGTCTATSGPGATNLVSGLADANALS012.0031METHQALTRSSTIRVULPRHEQGGVFAAEGYARSSGKPGTCTATSGPGATNLVSGLADANALS007.0671METHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGTCTATSGPGATNLVSGLADANALS007.0671METHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGTCTATSGPGATNLVSGLADANALS007.0671METHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGTCTATSGPGATNLVSGLADANALS007.0671METHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGTCTATSGPGATNLVSGLADANALS012.0032LDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATALS012.0032LDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATALS012.0672LDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATAVANZA641LDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATLDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATLDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATLDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATLDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATLDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATLDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATLDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATLDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATLDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATLDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATLDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATLDSVPLVATTGQVPRRMIGTDAFQETPTVEVTRSTTKHNYLVMDVDDTPRTVQEAFFLATLDSVPLVATTGQVPRRM	ALS012.0082	1	MEIHOALTRSSTIRNVLPRHEOGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAM
CL1984.29611MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADARALS012.00311MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADARALS007.06711MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADARALS007.06711MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADARCanola161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATChrB0561LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQE	CL19B4.2951	1	MEIHOALTRSSTIRNVLPRHEOGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAM
ALS012.00311MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADARALS007.06711MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADARCanola161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCanola161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.067261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATChrB0561LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295461LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295461LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295461LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295461LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295461LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAF	CL19B4.2952	1	MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAM
ALS007.06711MEINQAURASSTIRAVUERABQGGVTAALGURASSGAFGTCTATSGPGATALVSGLADARALS007.06711MEIHQALTRSSTIRAVUERHEQGGVFAAEGYARSSGKPGTCTATSGPGATALVSGLADARCanola161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.067261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATChrB0561LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIV	CL19B4.2961	1	MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAM
Canola261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCanola161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.067261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATChrB0561LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.296261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.296161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.296161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.296161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT	ALS012.0031	1	MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAM
Canola261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCanola161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.067261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATChrB0561LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.296261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.296161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.296161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.296161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT	ALS007.0671	1	MEIHQALTRSSTIRNVLPRHEQGGVFAAEGYARSSGKPGICIATSGPGATNLVSGLADAM
CaloraALS012.003261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.067261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATChrB0561LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.296261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL1984.296161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT	Canola2	-	LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT
ALS012.003261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.067261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATChrB0561LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.296261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.296161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.296161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT		61	LDSVPLVAITGOVPRRMIGTDAFOETPIVEVTRSITKHNYLVMDVDDIPRIVOEAFFLAT
ALS012.067261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATChrB0561LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.296161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT		61	LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT
AVANZA64161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATAVANZA64261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATChrB0561LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.296261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.296161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT		61	LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT
ChrB0561LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.296261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.008261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.295261LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.296161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATCL19B4.296161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLATALS012.003161LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT		61	LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT
CL19B4.2962 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT ALS012.0081 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT ALS012.0082 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL19B4.2951 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL19B4.2952 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL19B4.2961 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT ALS012.0031 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT	AVANZA642	61	LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT
ALS012.0081 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT ALS012.0082 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL19B4.2951 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL19B4.2952 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL19B4.2961 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT ALS012.0031 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT	ChrB05	61	LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT
ALSO12.0082 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL19B4.2951 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL19B4.2952 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL19B4.2961 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT ALSO12.0031 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT	CL19B4.2962	61	LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT
CL19B4.2951 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL19B4.2952 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL19B4.2961 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT ALSO12.0031 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT	ALS012.0081	61	LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT
CL19B4.2952 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT CL19B4.2961 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT ALS012.0031 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT	ALS012.0082	61	LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT
CL19B4.2961 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT ALSO12.0031 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT	CL19B4.2951	61	LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT
ALS012.0031 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT	CL19B4.2952	61	이 것 것 것 것 같은 것 같은 것 같은 것 같은 것 같은 것 같은 것
	CL19B4.2961	61	LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT
ALS007.0671 61 LDSVPLVAITGQVPRRMIGTDAFQETPIVEVTRSITKHNYLVMDVDDIPRIVQEAFFLAT	ALCO12 0021	61	I.DSVPI.VATTGOVPRRMIGTDAFOFTPIVEVTRSTTKHNYI.VMDVDDTPRIVOFAFFI.AT
	AL3012.0031	04	

No mutation found

Region I multiple sequence alignment ChrB09

Threonine to Isoleucine (Not reported)



One new mutation Iso to Thr was found

Region II multiple sequence alignment

	190	200	210	220	230	240
ChrC09:26880203-26882370rev	TAGCAGGGCTAAA	ATTGTGCACA	AGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	TAAGAC
ChrB05:13552239-13554406	GAGCAGGGCTAAG	ATTGTGCACA	TGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	CAAGAC
CL19B4.2952	GAGCAGGGCTAAG	ATTGTGCACA	TGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	CAAGAC
CL19B4.2961	GAGCAGGGCTAAG	ATTGTGCACA	TGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	CAAGAC
CL19B4.2962	GAGCAGGGCTAAG	ATTGTGCACA	TGACATTGAT	TCTGCTGAGE	TTGGGAAGAA	CAAGAC
ALS012.0081	GAGCAGGGCTAAG	ATTGTGCACA	TGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	CAAGAC
ALS012.0082	GAGCAGGGCTAAG	ATTGTGCACA	TGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	CAAGAC
ALS012.0032	GAGCAGGGCTAAG	ATTGTGCACA	TGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	CAAGAC
CL19B4.2951	GAGCAGGGCTAAG	ATTGTGCACA	TGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	CAAGAC
ALS012.0031	GAGCAGGGCTAAG	ATTGTGCACA	TGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	CAAGAC
ALS007.0671	GAGCAGGGCTAAG	ATTGTGCACA	TGACATTGAT	TCTGCTGAG	TTGGGAAGAA	CAAGAC
ALS007.0672	GAGCAGGGCTAAG	ATTGTGCACA	TGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	CAAGAC
AVANZA642	TAGCAGGGCTAAA	ATTGTGCACA	TGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	CAAGAC
AVANZA641	TAGCAGGGCTAAA	ATTGTGCACA	TGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	CAAGAC
CANOLA1	TAGCAGGGCTAAA	ATTGTGCACA	FAGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	TAAGAC
CANOLA2	TAGCAGGGCTAAA	ATTGTGCACA	TAGACATTGAT	TCTGCTGAGA	TTGGGAAGAA	TAAGAC
	250	260	270	280	290	300
ChrC09:26880203-26882370rev	ACCTCACGTGTCTC					
ChrB05:13552239-13554406	GCCTCATGTGTCTC					
CL19B4.2952	ACCTCATGTGTCTC					
CL19B4.2961 CL19B4.2962	ACCTCATGTGTCTC					
ALS012.0081	ACCTCATGTGTCTC ACCTCATGTGTCTC					
ALS012.0081 ALS012.0082	ACCTCATGTGTGTCTC					
ALS012.0082 ALS012.0032	ACCTCATGTGTGTCTC					
CL19B4.2951	ACCTCATGTGTCTC					
ALS012.0031	ACCTCATGTGTCTC					
ALS012.0031	ACCTCATGTGTCTC					
ALS007.0672	ACCTCATGTGTCTC					
AVANZA642	ACCTCATGTGTCTC					
AVANZA641	ACCTCATGTGTCTC					
CANOLA1	ACCTCACGTGTCTC					
CANOLA2	ACCTCACGTGTCTC					
UTATU ALTA	Heenengererer	1010100101	Tor Annocio	o o r i r o c AAG	oonnonnonn	

No mutation found

Region III multiple sequence alignment ChrB05

CANOLA1	1	MNVQELATIRVENLPVKVLLLNNQHLGMVM
ALS012.0032	1	MNVQELATIRVENLPVKVLLLNNQHLGMVM
ChrB05:13552239		MGFGLPAAIGASVANPDAIVVDIDGDGSFI <mark>MNVQELATIRVENLPVKVLLLNNQHLGMVM</mark>
CL19B4.2951	1	MGSGLPAAIGASVANPDAIVVDIDGDGSFI <mark>MNVQELATIRVENLPVKVLLLNNQHLGMVM</mark>
ALS012.0031	1	MNVQELATIRVENLPVKVLLLNNQHLGMVM
ALS012.0081	1	MG-LDSCCIGASVANPDAIVVDIDGDGSFIMNVQELATIRVENLPVKVLLLNNQHLGMVM
ALS012.0082	1	MNVQELATIRVENLPVKVLLLNNQHLGMVM
CL19B4.2952	1	MNVQELATIRVENLPVKVLLLNNQHLGMVM
CL19B4.2961	1	MNVQELATIRVENLPVKVLLLNNQHLGMVM
CL19B4.2962	1	MNVQELATIRVENLPVKVLLLNNQHLGMVM
ALS007.0671	1	MNVQELATIRVENLPVKVLLLNNQHLGMVM
ALS007.0672	1	MNVQELATIRVENLPVKVLLLNNQHLGMVM
AVANZA641	1	MNVQELATIRVENLPVKVLLLNNQHLGMVM
AVANZA642	1	MNVQELATIRVENLPVKVLLLNNQHLGMVM
CANOLA2	1	MNVQELATIRVENLPVKVLLLNNQHLGMVM
CANOLA1	31	QWEDRFYKANRAHTYLGDPAKENEIFPNMLQFAGACGIPAARVT
ALS012.0032	31	QWEDRFYKANRAHTYLGDPAKENEIFPNMLQFAGACGIPAARVTKKEEL <mark>E</mark> DAIQTMLDTP
ChrB05:13552239	61	QWEDRFYKANRAHTYLGDPAKENEIFPNMLQFAGACGIPAARVTKKEELRDAIQTMLDTP
CL19B4.2951	61	QWEDRFYKANRAHTYLGDPAKENEIFPNMLQFAGACGIPAARVTKKEELRDAIQTMLDTP
ALS012.0031	31	QWEDRFYKANRAHTYLGDPAKENEIFPNMLQFAGACGIPAARVTKKEELRDAIQTMLDTP
ALS012.0081	60	QWEDRFYKANRAHTYLGDPAKENEIFPNMLQFAGACGIPAARVTKKEELRDAIQTMLDTP
ALS012.0082	31	QWEDRFYKANRAHTYLGDPAKENEIFPNMLQFAGACGIPAARVTKKEELRDAIQTMLDTP
CL19B4.2952	31	OWEDRFYKANRAHTYLGDPAKENEIFPNMLOFAGACGIPAARVTKKEELRDAIOTMLDTP
CL19B4.2961	31	OWEDRFYKANRAHTYLGDPAKENEIFPNMLOFAGACGIPAARVTKKEELRDAIOTMLDTP
CL19B4.2962	31	OWEDRFYKANRAHTYLGDPAKENEIFPNMLOFAGACGIPAARVTKKEELRDAIOTMLDTP
ALS007.0671	31	OWEDRFYKANRAHTYLGDPAKENEIFPNMLOFAGACGIPAARVTKKEELRDAIOTMLDTP
ALS007.0672	31	OWEDRFYKANRAHTYLGDPAKENEIFPNMLOFAGACGIPAARVTKKEELRDAIOTMLDTP
AVANZA641	31	OWEDRFYKANRAHTYLGDPAKENEIFPNMLOFAGACGIPAARVTKKEELRDAIOTMLDTP
AVANZA642	31	OWEDRFYKANRAHTYLGDPAKENEIFPNMLOFAGACGIPAARVTKKEELRDAIOTMLDTP
CANOLA2	31	OWEDRFYKANRAHTYLGDPAKENEIFPNMLOFAGACGIPAARVTKKEELRDAIOTMLDTP
CANOLA1	91	GPYLLDVICPHOEHVLPMIPSGGTFKDVITEGDGRTKY
ALS012.0032	91	GPYLLDVICPHOEHVLPMIPSGGTFKDVITEGDGRTKY
ChrB05:13552239	121	GPYLLDVICPHQEHVLPMIPSGGTFKDVITEGDGRTKY
CL19B4,2951	121	GPYLLDVICPHQEHVLPMIPSGGTFKDVITEGDGRTKY
ALS012.0031	91	GPYLLDVICPHOEHVLPMIPSGGTFKDVITEGDGRTKY
ALS012.0081	120	GPYLLDVICPHOEHVLPMIPSGGTFKDVITEGDGRTKY
ALS012.0082	91	GPYLLDVICFHQEHVLPMIPSGGTFKDVITEGDGRTKY
CL19B4.2952	91	GPYLLDVICFHQEHVLPMIPSGGTFKDVITEGDGRTKY
CL19B4.2961	91	GPYLLDVICPHOEHVLPMIPSGGTFKDVITEGDGRTKY
CL19B4.2961 CL19B4.2962	91	GPYLLDVICPHQEHVLPMIPSGGTFKDVITEGDGRTKY
ALS007.0671	91	GPYLLDVICPHQEHVLPMIPSGGTFKDVITEGDGKTKY GPYLLDVICPHQEHVLPMIPSGGTFKDVITEGDGRTKY
ALS007.0671	91	GPYLLDVICPHQEHVLPMIPSGGTFKDVITEGDGKTKY GPYLLDVICPHQEHVLPMIPSGGTFKDVITEGDGRTKY
	91	GPYLLDVICPHQEHVLPMIPSGGTFKDVITEGDGRTKY
AVANZA641		
AVANZA642	91 91	GPYLLDVICPHQEHVLPMIPSGGTFKDVITEGDGRTKY
CANOLA2	91	GPYLLDVICPHQEHVLPMIPSGGTFKDVITEGDGRTKY

No mutation found

ALS012.0082

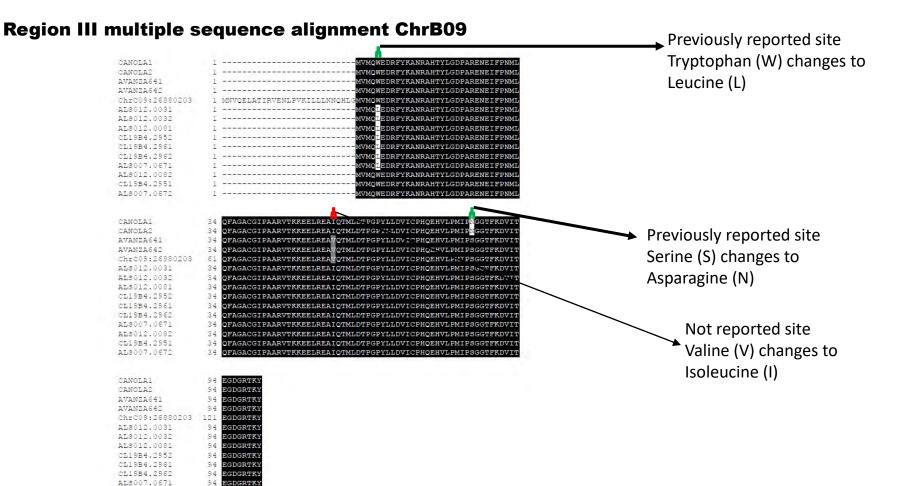
CL19B4.2951

ALS007.0672

94 EGDGRTKY

94 EGDGRTKY

94 EGDGRTK

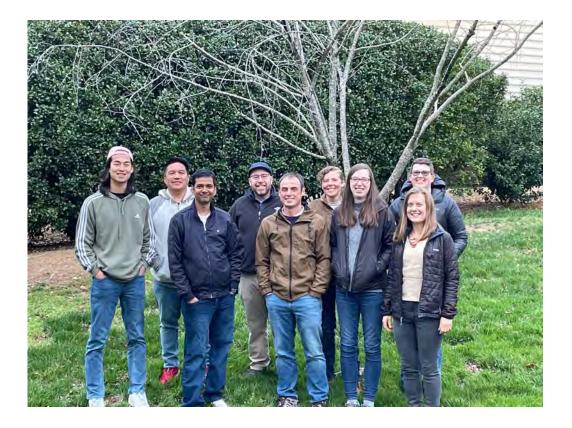


One new mutation Val to Iso was found

Weed Risk Assessment

Assessment	Minimum score for rejection	Obtained Score	Outcome
Australian WRA			
Total	6	6	Needs further evaluation
Agricultural		2	
Environmental		3	
Pre Tool	11	6	Accept

Acknowledgements







USDA ONRCS United States Department of Agriculture Natural Resources Conservation Service

