THE MYSTERY OF THE FREAK POTATOES & VEGETABLES

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"Can you come and look at my potatoes… Something <u>really STRANGE</u> is going on!!"

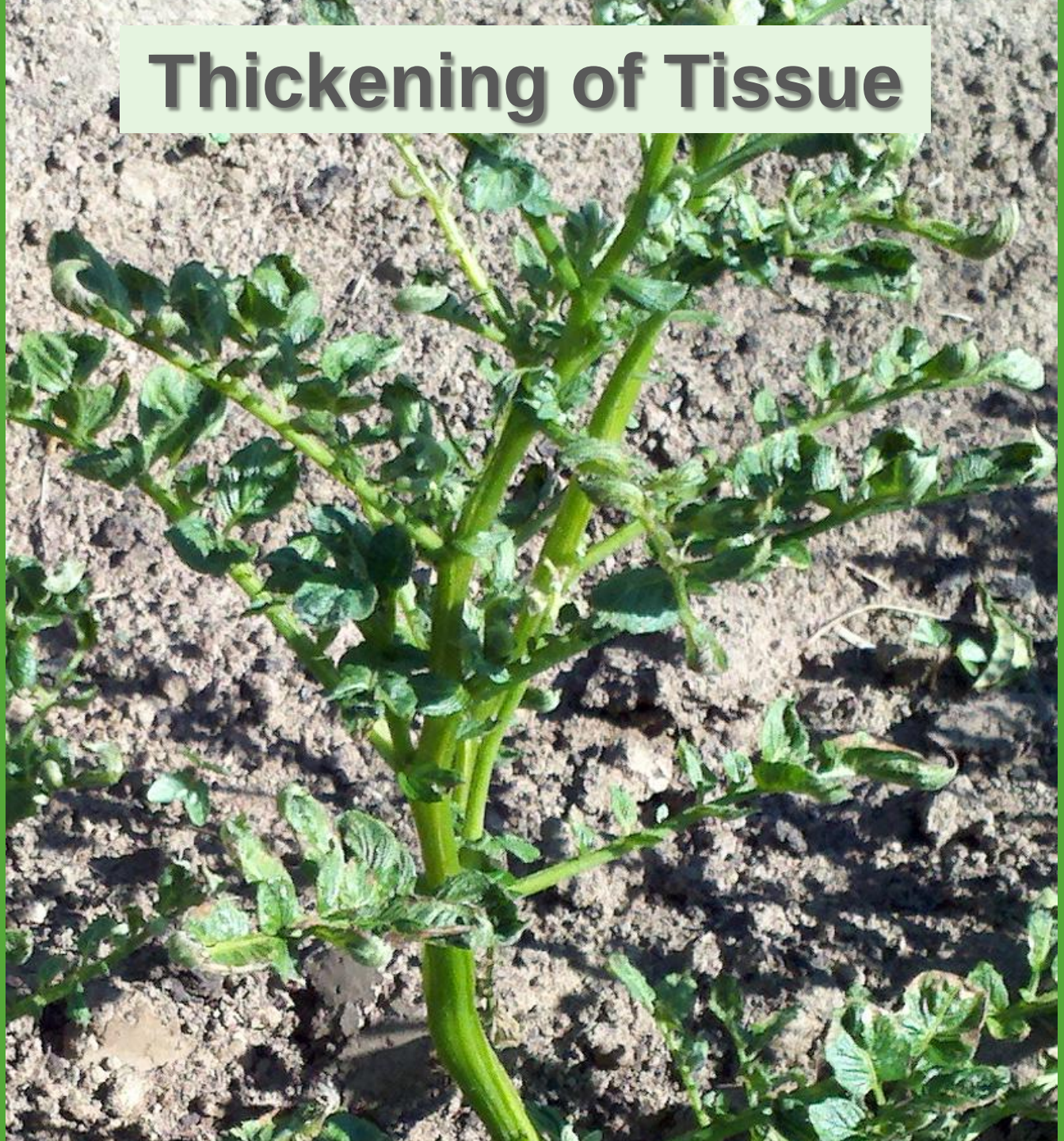
Healthy potato plants

Abnormal Leaf Expansion

Leaf cupping


Fiddleheading

Thickening of Tissue



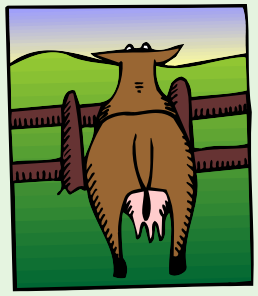
Confirming the Diagnosis: Putting all the Pieces Together

The Behind the Scenes Story

- Market gardener renting field from Farmer Jones
- Entire area was plowed up
- Half plowed area was not amended with anything, whereas other half was amended with cured cow manure (stored in barn for a few years)
- Side without manure did NOT have any injury symptoms, whereas side with manure DID have strange effects
- Effects were non-uniform (spotty here and there)
- Look at this schematically…..

Farm Field Layout

Plowed

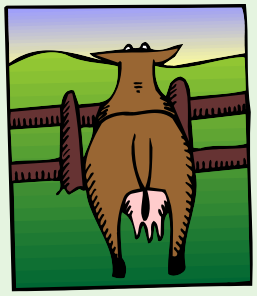


Plowed + Manure

NO PLANT INJURY

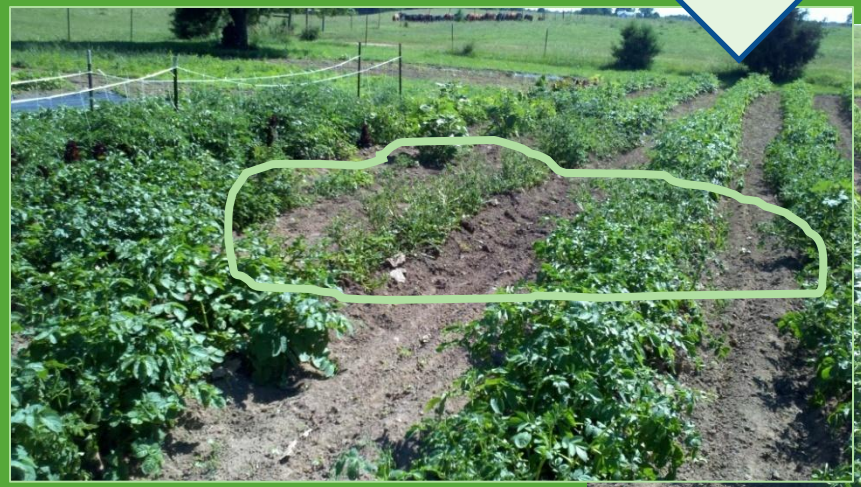
Plowed

PLANT INJURY



Plowed + Manure

Injury Hot-spots
in the field



Coincides with where manure was dumped in the field before incorporation

The Final Clue…

- **What's in the Poo??**
  - **The manure was from cows that had grazed on pasture area near this site**
  - **The site had been sprayed with Grazon herbicide, a mixture of picloram and 2,4-D**
  - **The manure had been stored for a few years in a nice, protected environment (barn)**
  - **It was then applied to the field in question**
  - **All the symptoms were classic injury symptoms from residual activity of pyridine-based herbicides**

Thus, the cow manure was laden with the Grazon even after 4 years and was the culprit!!

Just one freaky case??

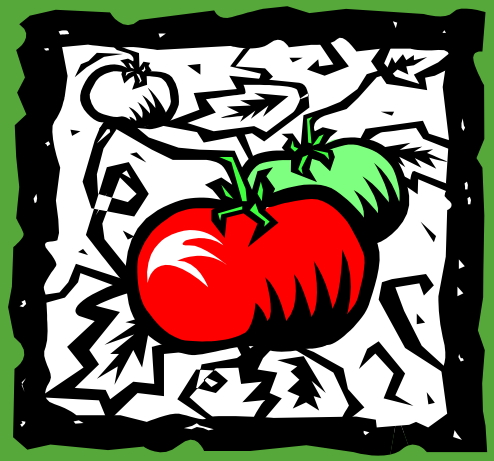
Waterpenny Farm

- CSA Farm in Rappahanock Co. approached the season as any other

- They prepared the soil by tilling and incorporating organic matter, transplanted out various seedlings into their rows, and placed straw mulch in between rows to conserve moisture

- The plants were looking nicely

- Some rain came and within a short time, many of their plants began to look weird, deformed and strange resulting in a significant yield reduction and all out loss of plants



CSA Farm-

- Purchased 50,000 pounds of hay to mulch fields planted in various vegetable crops

- Plants started showing bizarre symptoms

- Hay had been purchased from another local farmer, who had sprayed the hay fields with Grazon

- Rain event leached herbicide residuals into soil profile

- As plant roots expanded into mulched areas in between rows, they actively took up herbicide, resulting in symptoms evidenced

A Closer Look at Pyridine Herbicides

What are the Pyridine Herbicides?

- Active ingredients: Aminopyralid, Clopyralid, and Picloram
- Some commonly used herbicides in this category:
  - -- Milestone (A)
  - -- Confront (C)
  - -- Stinger (C)
  - -- Grazon (P, 2,4-D)
  - -- Tordon (P)
  - -- ForeFront (A)
  - -- Redeem (C)
  - -- Imprelis (C)
  - -- Surmount (P)

- **RESTRICTED USE** pesticide & registered for control of wide variety of broadleaf weeds use in pasture, grain crops, lawns, & roadsides

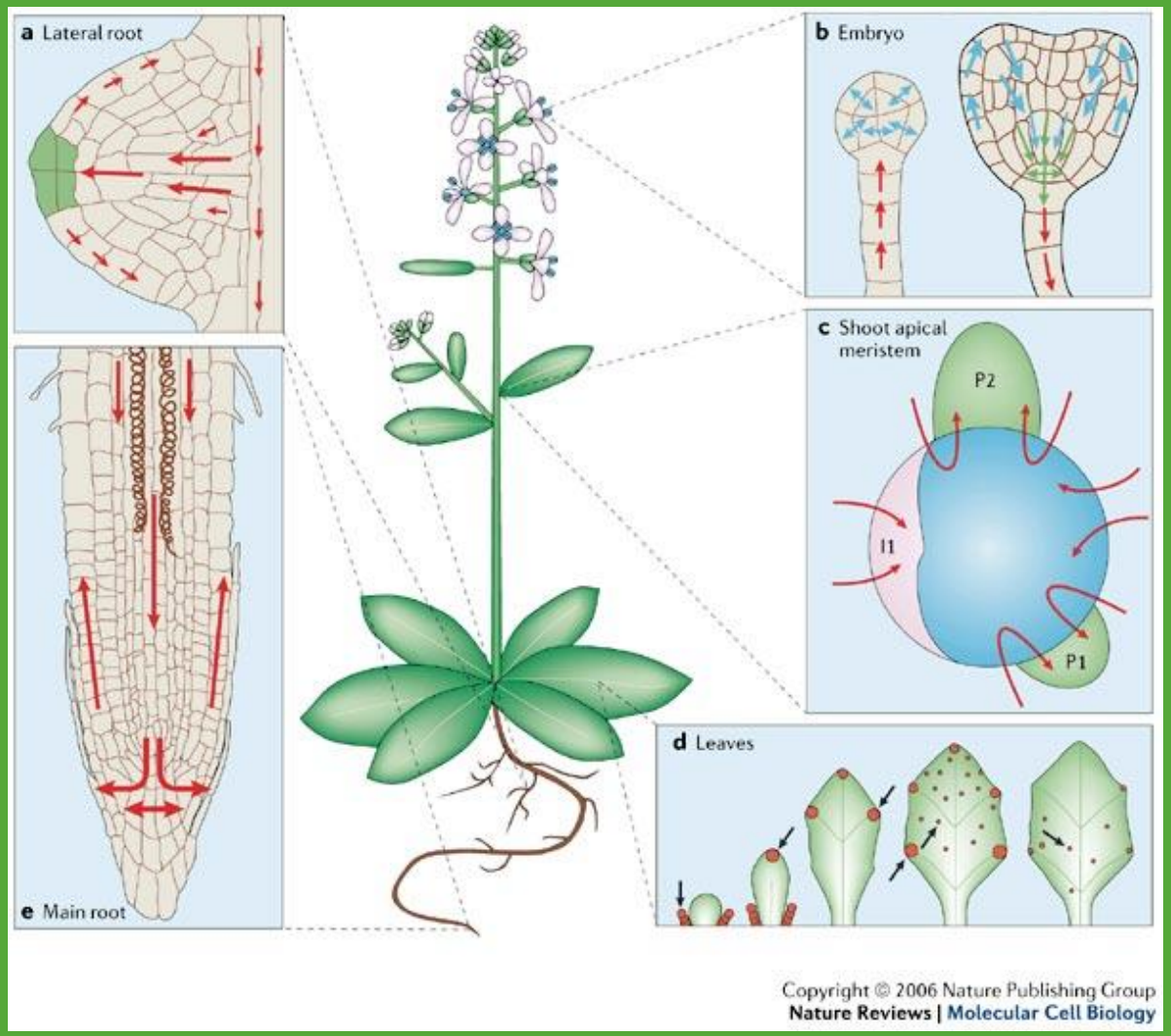
- Provides **long-term efficacy in hard-to-control broadleaf weeds**

- Doesn't harm animals grazing on pasture or hay sprayed with them

- **Is PERSISTENT** and may remain **ACTIVE** in hay, straw, grass clippings, and manure **EVEN when they have been composted**

How do Pyridine Herbicides Work?

- Mimics plant growth regulators called auxins that cause cells to divide and elongate, and to form cell walls



Symptoms of Pyridine Herbicide Carryover

Excessive cell division and elongation, & Abnormal cell wall development → Bent and twisted Stems

Symptoms of Pyridine Herbicide Carryover

Cupping of the Leaves in Cucurbits

Cupping of the Leaves in Soybean

Symptoms of Pyridine Herbicide Carryover

Thickened tissue → “Draw-stringed” Soybean Leaves

Symptoms of Pyridine Herbicide Carryover

Thickened Callus Tissue

Symptoms of Pyridine Herbicide Carryover

Thickened Callus Tissue & Fiddleheading

Susceptible Crops Affected

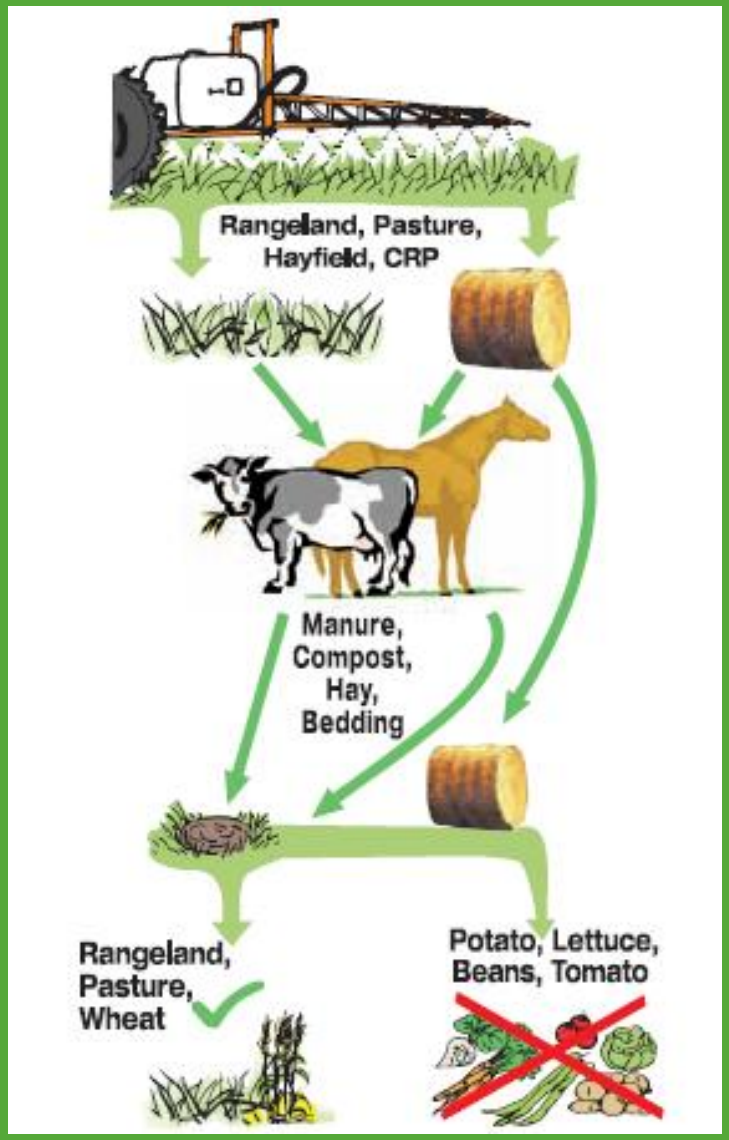
- Beans
- Carrots
- Compositae family
- Dahlias
- Eggplant
- Flowers, in general
- Grapes
- Legumes
- Lettuce
- Marigolds
- Mushrooms
- Peas
- Peppers
- Potatoes
- Roses, some types
- Spinach
- Sugar beets
- Strawberries
- Sunflowers
- Tobacco
- Tomatoes
- Umbelliferae
- Vegetables, in general

How Do Pyridine Herbicide Carry-over to Non-target Plants?

- Herbicides are **PERSISTENT** and may remain **ACTIVE** in hay, straw, grass clippings, and manure **EVEN when they have been composted**

- Problems arise when stored hay, manure, grass clippings, or other residue-affected materials are sold or given away and used on areas where sensitive plants grown

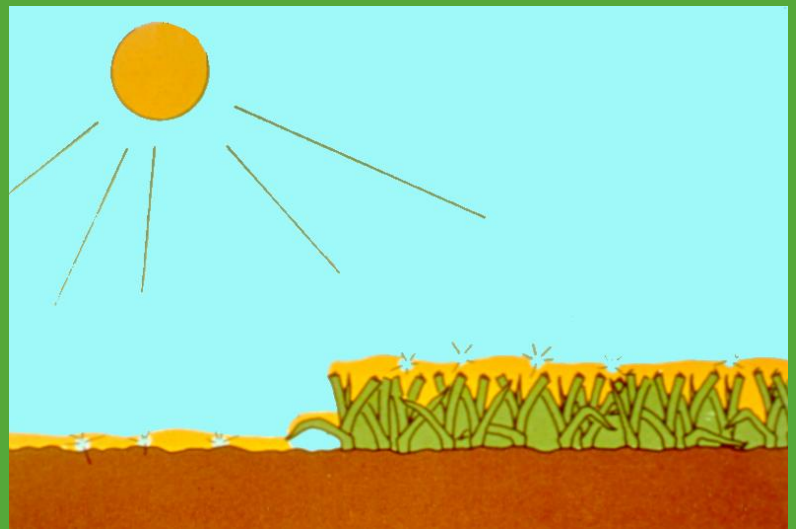
- Crucial to **know history** of these materials & herbicides applied in order to avoid off-target problems!!!!!

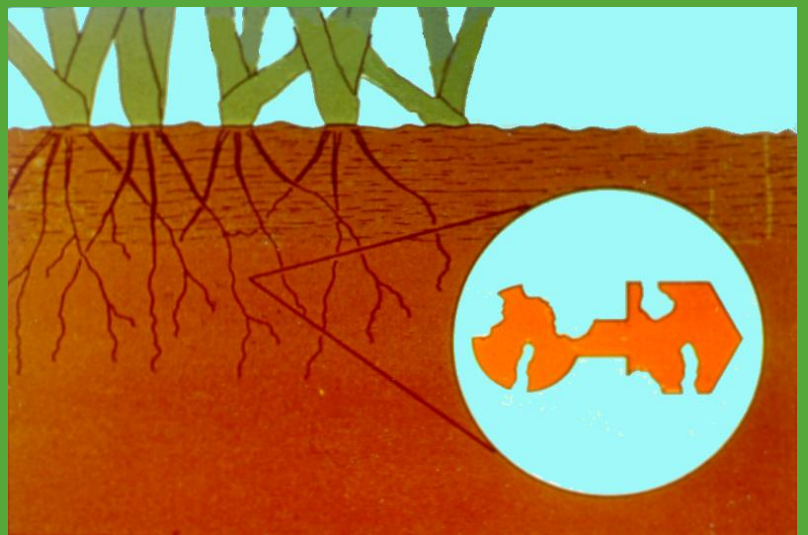


Farmers and Gardeners

Before acquiring or using manure- fresh, aged, or composted- need to ask some important questions:

- What were the animals fed?
- If fed hay, what was the origin—on site or purchased?
- If hay or pasture-fed, what, if any, herbicides were applied and when?
- Remember, **even if composted**, degradation of herbicides is slow in piles, since break down of these herbicides needs exposure to sunlight, moisture, and microbes





Livestock & Horse Dealers

Before buying or taking bedding/manure that may have pyridine-based herbicide residues, important to keep in mind the following points:

- **Source of hay/feed and bedding materials?**

- **If hay or pasture-fed, what, if any, herbicides were applied? When? How soon after herbicide application did animals feed, or was feed cut?**

- **Straw used for bedding and any herbicide applications?**

- **What will you be using the straw/bedding/manure for?**

Hay Producers and Dealers

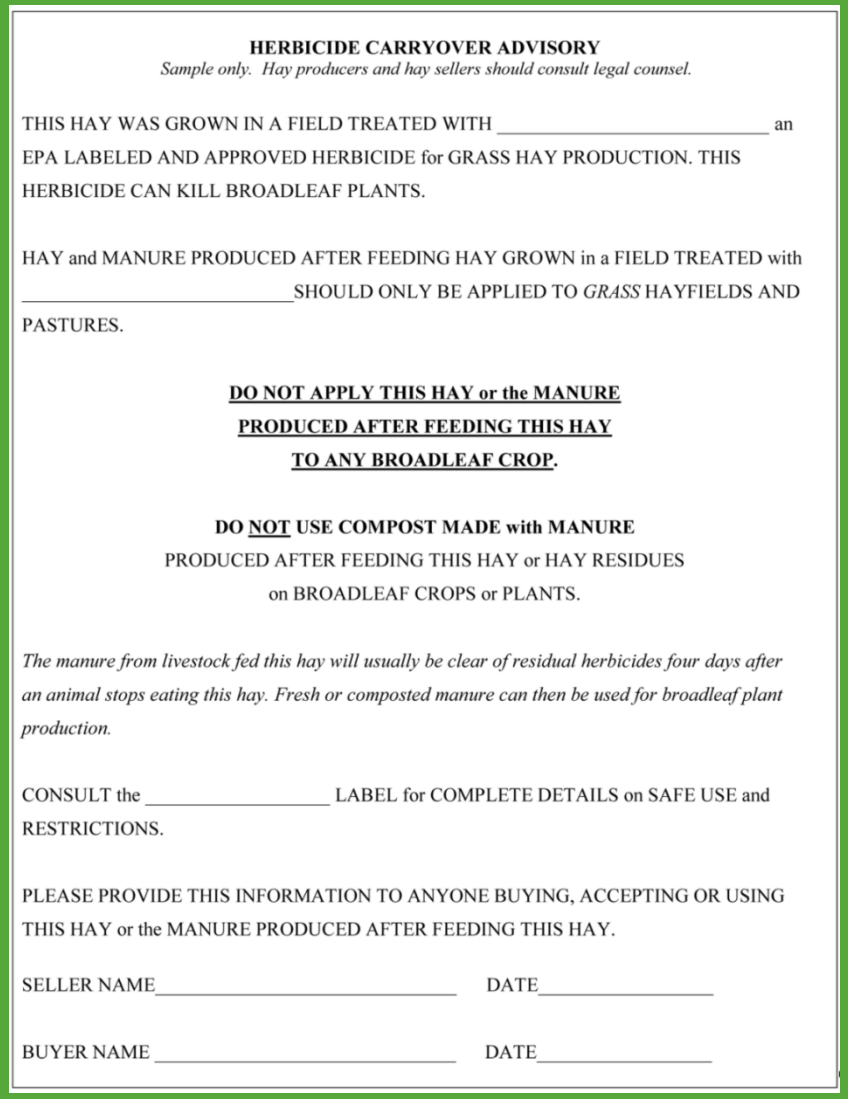
Before using and/or selling hay treated with pyridine-based herbicides, important to keep in mind the following points:

- **What herbicide was hay treated with?**
- **When was the hay cut and baled?**
- **How long after herbicide treatment? Which cutting? (Half-life not well known)**
- **How was the hay stored? How long stored? (If wrapped/stored 3+ years!)**

Ask Provider if they have a Policy of Disclosure

- To avoid problems of liability, some producers are providing a history of pesticides used and potential danger to non-target broadleaf plants (in NCSU hand-out)

- **Ask provider whether they have such an advisory**



HERBICIDE CARRYOVER ADVISORY

Sample only. Hay producers and hay sellers should consult legal counsel.

THIS HAY WAS GROWN IN A FIELD TREATED WITH _____ an EPA LABELED AND APPROVED HERBICIDE for GRASS HAY PRODUCTION. THIS HERBICIDE CAN KILL BROADLEAF PLANTS.

HAY and MANURE PRODUCED AFTER FEEDING HAY GROWN in a FIELD TREATED with _____SHOULD ONLY BE APPLIED TO *GRASS* HAYFIELDS AND PASTURES.

DO NOT APPLY THIS HAY or the MANURE PRODUCED AFTER FEEDING THIS HAY TO ANY BROADLEAF CROP.

DO NOT USE COMPOST MADE with MANURE PRODUCED AFTER FEEDING THIS HAY or HAY RESIDUES on BROADLEAF CROPS or PLANTS.

The manure from livestock fed this hay will usually be clear of residual herbicides four days after an animal stops eating this hay. Fresh or composted manure can then be used for broadleaf plant production.

CONSULT the _____ LABEL for COMPLETE DETAILS on SAFE USE and RESTRICTIONS.

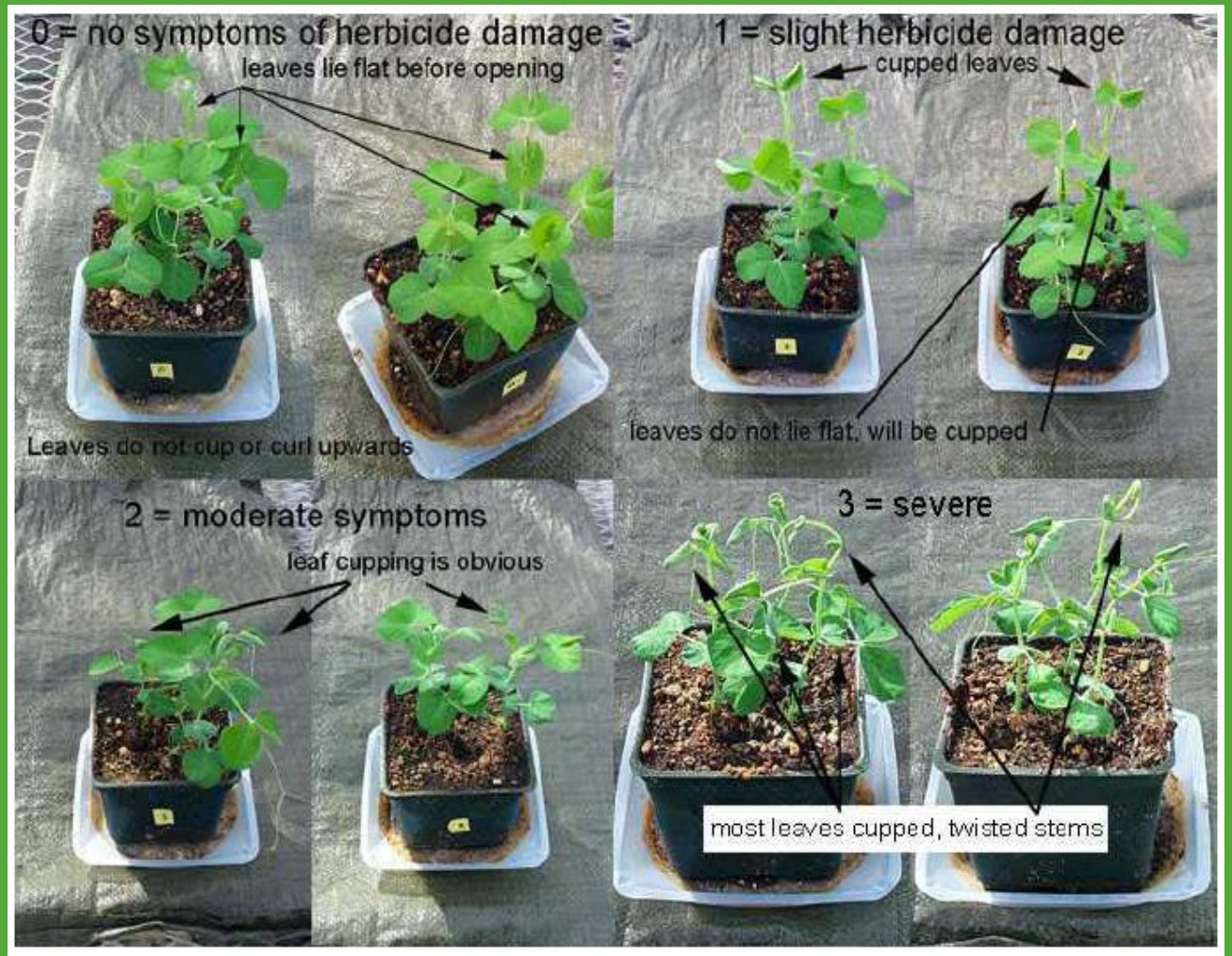
PLEASE PROVIDE THIS INFORMATION TO ANYONE BUYING, ACCEPTING OR USING THIS HAY or the MANURE PRODUCED AFTER FEEDING THIS HAY.

SELLER NAME_____ DATE_____

BUYER NAME _____ DATE_____

Farmers and Gardeners

- **If history is unknown of materials, perform pot or field bioassay before planting any sensitive crops (from Washington State University)**



Other Final Points

- Animal manures and composts are excellent sources of nutrients and organic matter, as are hay and grass clippings

- Herbicides used to grow hay and control pasture weeds are important tools for many farmers

- Remember, as the **end-user**, **BE INFORMED and know related restrictions for end uses of the crop the herbicide is being initially applied to**, **EVEN when it is for indirect uses such as manure and compost**

- Persistent pyridine herbicides in contaminated manure, compost, hay, and grass clippings **take a lot longer to break down in piles**, so **do not risk using on sensitive crops**

- If in doubt, **DO NOT USE in the garden** → Best to spread them on field or area where **non-sensitive crops will or are growing (corn, grass)**