Integrated Pest Management of Insect Pests in Grain Sorghum

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Insects in Grain Sorghum

- Major pests
  - Greenbug
- Occasional pests
  - Grasshoppers
  - Cutworms

Greenbug Identification

- The greenbug is an aphid with a bright pale-green body and a prominent blue-green stripe running lengthwise along the top of the abdomen. The tips of the antennae and cornicles are black.

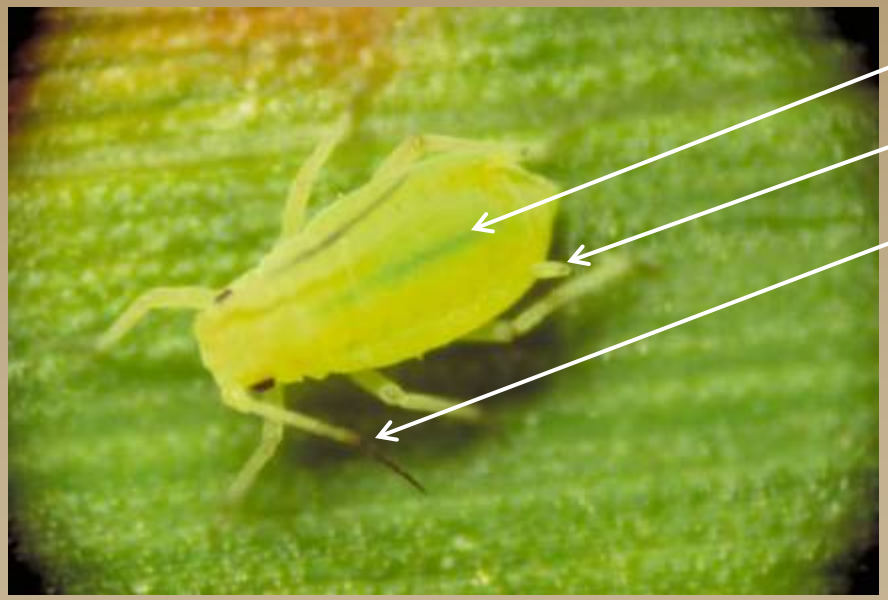
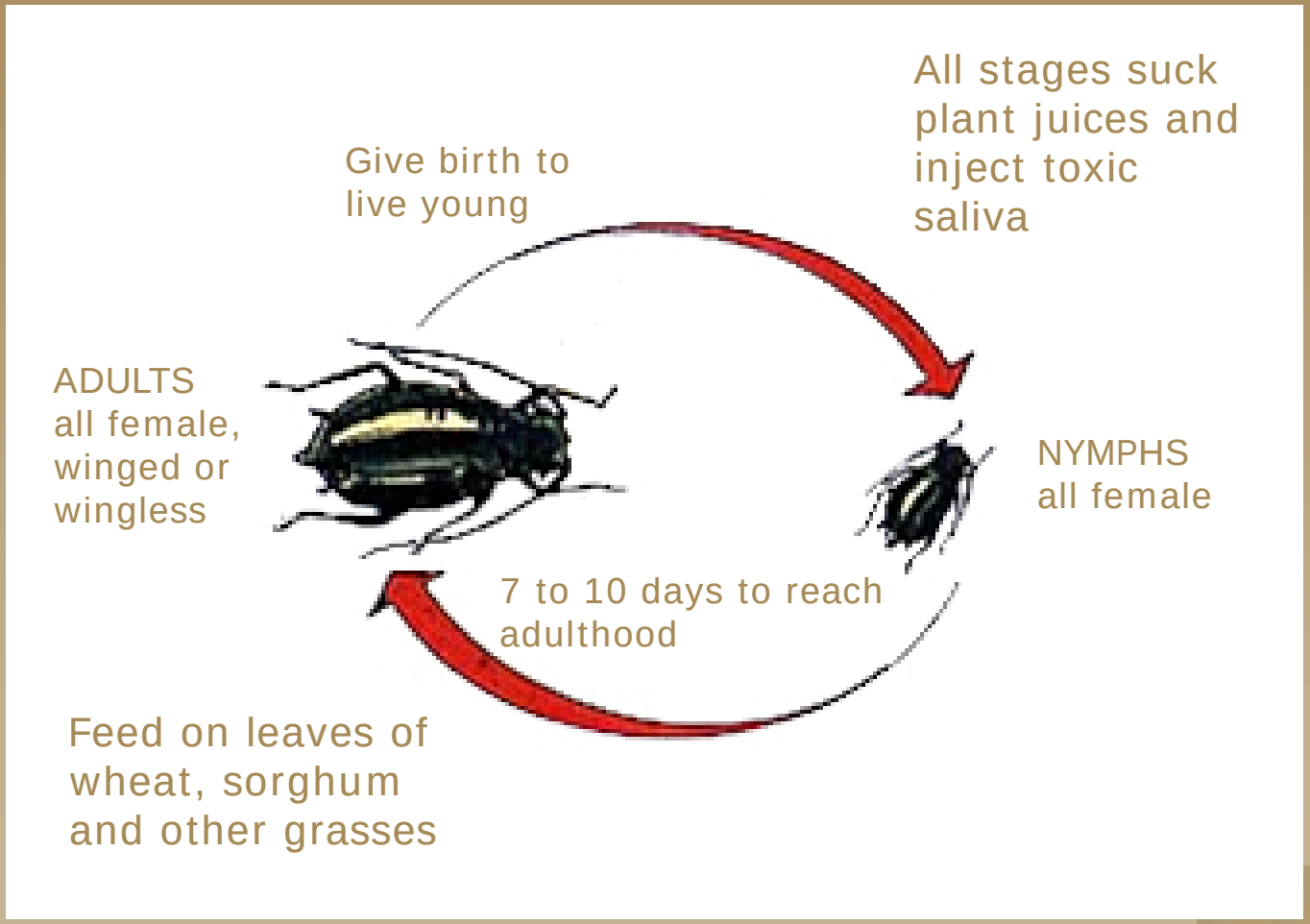


Image credit: Extension Entomology, Texas A&M University

Greenbug Life Cycle

- Not known to overwinter in ND
- Winged females blown into ND from southern states in spring and early summer
- Females establish colonies on small grain crops, including sorghum

Greenbug Life Cycle



Greenbug Feeding Injury

- Greenbug causes injury to sorghum by injecting phytotoxic saliva while feeding
- Feed in colonies on the underside of leaves, but may be anywhere on the plant in early growth stages
- Symptoms begin as reddish spots on leaves, which enlarge as feeding continues and greenbug populations grow
- Damaged leaves die, turning yellow and then brown from the outer edges inward

Greenbug Feeding Injury

Image credt: Alton N. Sparks, Jr., University of Georgia, Bugwood.org

Greenbug Control

- IPM tactics for greenbug control include the following:
  - Host-Plant Resistance
  - Biological Control
  - Chemical Control

Greenbug Control

- Host-plant Resistance
  - Plant sorghum varieties that show resistance to greenbugs and are adapted for North Dakota (if any)
  - Economic thresholds for resistant and non-resistant varieties are the same

Greenbug Control

- Biological Control
  - Greenbugs and non-injurious aphids attract a wide range of predators and parasitoids that can negatively impact greenbug population levels

Greenbug Control

- Chemical Control
  - Insecticides should not be used until the economic threshold is reached to allow beneficial insects to provide as much biological control as possible
  - Crop value, yield potential, and insecticide costs must be considered
  - Several insecticides are labeled for use on greenbug and other aphids in North Dakota

Greenbug Economic Threshold

- Economic thresholds for greenbug vary depending on plant stage
- Greenbug populations can increase rapidly, usually five- to six-fold per week depending on environmental conditions
- Sorghum is more susceptible to injury when under drought stress

Plant Size and Stage	When to Treat
Emergence to 6 inches	Red spotting with colonies of greenbugs present on 20% of plants
Larger plant to boot	Red spotting and leaf yellowing with colonies of greenbugs present on 20% of plants
Boot to heading	Red spotting and yellowing, but before the death of one leaf on 20% of plants
Heading to hard-dough	Red spotting and yellowing, but before the death of two leaves on 20% of plants

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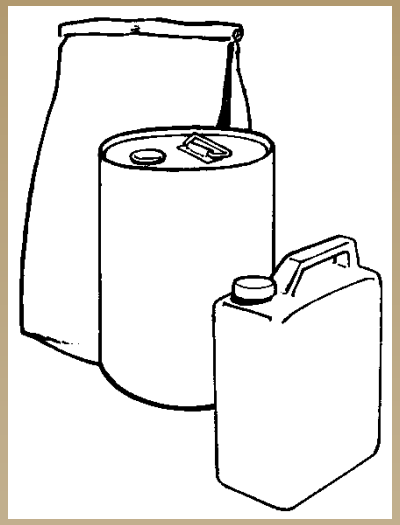
Insecticide Recommendations

Labeled for Greenbug Control in ND

Grain Sorghum



Always Read Labels.

- **Organophosphates**
  - Chlorpyrifos (Chlorpyrifos 4E AG*, Cobalt*)
- **Carbamates**
  - Aldicarb (Temik 15G*)
- **Neonicotinoids**
  - Thiamethoxam (Cruiser 5FS* seed treatment)

*** Restricted use pesticide**

Common Grasshoppers

Red-legged grasshopper

Differential grasshopper

Two-stripped grasshopper

Young Grasshoppers or Nymphs

- Look like adults
- Smaller than adults
- Wing pad instead of wings
- 5-6 nymphal stages or instars
- 4th or 5th instars present, hatch is winding down

Grasshopper Life Cycle

Eggs hatch

EARLY SPRING

1st Instar

SCOUT NOW!

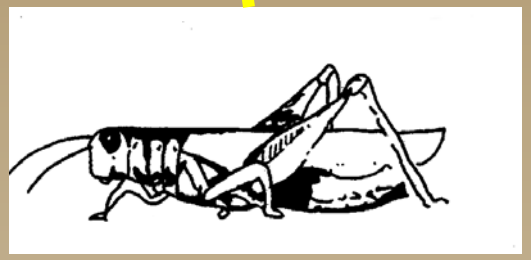
2nd Instar

LATE-JULY

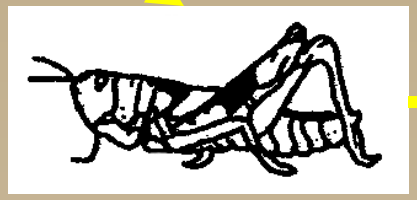
Surviving females lay eggs

3rd Instar

Grasshoppers molt 5 times



6th Instar ADULT



4th Instar

5th Instar

May - June

July - August

August - Sept

Grasshoppers

- Eggs are laid in the fall;
- Embryos develop while temperatures are favorable . . . There are wide ranges of development;
- This makes it difficult to predict hatch.

Lilac as an indicator:

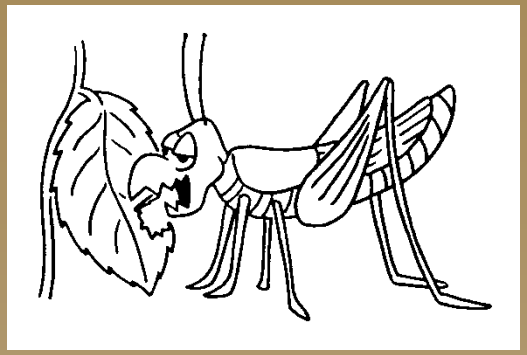
10 days after common lilac flowered, 75% of grasshoppers were first stage

Grasshopper Egg Laying

Start in late July through fall
Each female = 8-25 egg masses

Each egg pod = 20-120 eggs

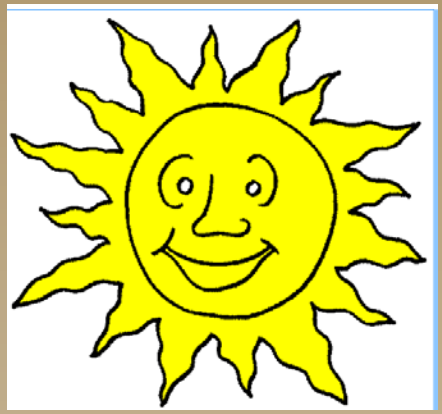
How Grasshopper Outbreaks Develop



- Weather dependent
  - hot, dry summers and warm falls
- Several years of gradual increase
  - LOW YEAR = 1 GH per square yard
  - FAVORABLE YEAR = 2 GH per square yard
  - ANOTHER YEAR = 4 GH per square yard
  - ANOTHER YEAR = 8 GH per square yard
  - ONE MORE = 24+ GH per square yard !!OUTBREAK!!

How Temperature Affects Grasshoppers

- High temperature in summer-fall
  - Early maturity
  - Long egg laying period
- Warm spring
  - Early hatch, followed by:
    - <70ºF - No feeding, high mortality
    - Warm and dry - Good start for hoppers

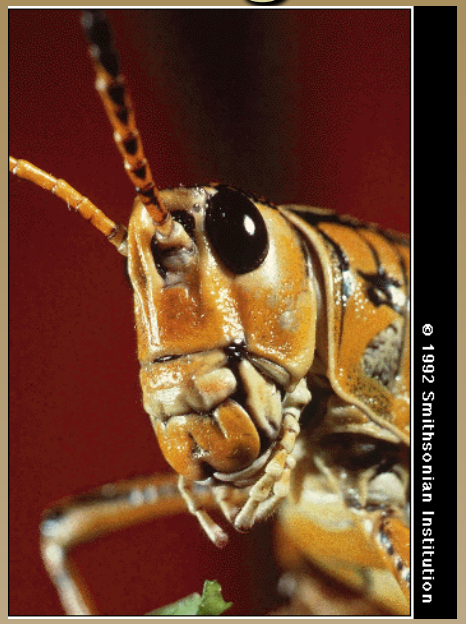


How Rainfall Affects Grasshoppers

- Cloudy, wet weather for 1+ weeks
  - Promotes fungal pathogens
- Heavy rains during emergence
  - Kills young grasshoppers
    - Embeds young in soil
    - Physically wash them away + drown
- Extreme drought
  - Poor egg hatch
  - Hoppers starve from lack of food
  - Low egg production by adults

Grasshopper Damage

- Chewing mouthparts
  - Leaf stripping
  - Head clipping



- High populations and scarce food plants
  - migrate --- “Migratory Locusts”
  - “Eat almost any plant they come upon”

Grasshopper Infestation Ratings

	Nymphs / sq. yd.		Adults / sq. yd.
Rating	margin	field	field
Light	25 - 35	15 - 25	3 - 7
Threatening	50 - 75	30 - 45	8 - 14
Severe	100 - 150	60 - 90	15 - 28
Very Severe	200+	120+	28+

Cultural Techniques

- Early seeding
  - Established, vigorously growing plants can tolerate more damage than younger plants
  - Risk of late season migration of adult grasshoppers is less
  - Not option for late-seeded crops
    - sunflower
    - dry beans
    - safflower
- Early harvest

Crop Rotation

- Crops should not be planted in fields with severe egg infestations
- Attractive fields = late season crops
  - dry beans
  - soybeans
  - sunflower
  - flax
  - corn

Impact of Tillage

- Little value to destroy eggs directly
- Early spring tillage before egg hatch
  - Starve nymphs
- Late summer tillage
  - Destroys vegetation making area less attractive for feeding and egg laying

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Insecticide Recommendations

Labeled for Grasshopper Control in ND

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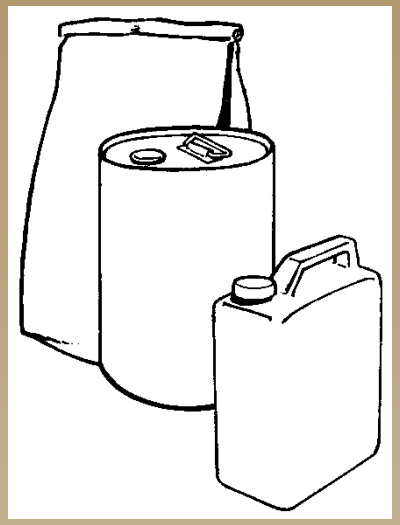

Always Read Labels.

Organophosphates

- Chlorpyrifos (Chlorpyrifos 4E AG*, Cobalt*, Govern*, Lorsban*, Nufos*, Warhawk*, Whirlwind*, Yuma*)
- Dimethoate
- Malathion (Fyfanon ULV)

Carbamates

- Carbaryl (Sevin)

* Restricted use pesticide

Insecticide Recommendations (continued)

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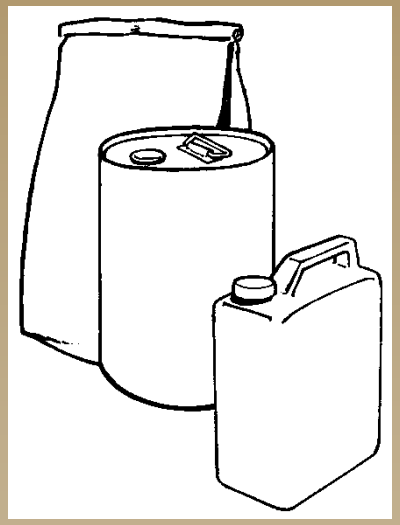


Always Read Labels.

Pyrethroids

- Beta-cyfluthrin (Baythroid XL*)
- Cyfluthrin (Tombstone*, Tombstone Helios*)
- Deltamethrin (Battalion*, Delta Gold*)
- Gamma-cyhalothrin (Proaxis*)
- Lambda-cyhalothrin (Lambda T*, Lambda-C, EC*, Mystic Z*, Silencer*, Warrior*, Taiga Z*)
- Zeta-cypermethrin (Mustang Max*, Respect*)

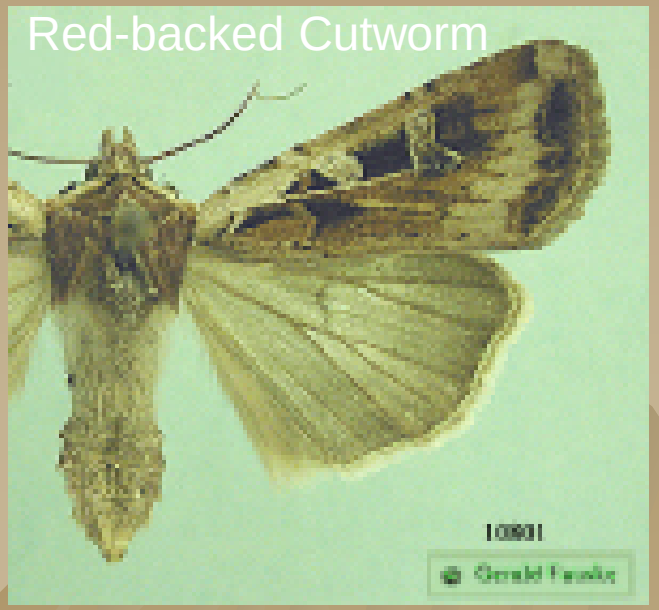
Biorationals

- Pyrethrin (Evergreen)
- Kaolin (Surround)

* Restricted use pesticide

Cutworm Identification

- **Adult**
  - **Very robust**
  - **Brown or black moths showing various spots or stripes in shades of gray, brown, black or white.**



Cutworm Identification

- **Larvae**
  - **stout, smooth, soft-bodied, plump caterpillars**
  - **Brown to tan to pink, green or gray and black**

http://www.ndsu.nodak.edu/ndsu/ndmoths/home.htm

NDSU - Moth Identification Website

NORTH DAKOTA STATE UNIVERSITY FARGO, N.D.

NDSU SEARCH

PHONEBOOK

Photo Gallery

If you are unfamiliar with the major groupings of moths, it is strongly recommended that you narrow your choice to family by using the keys or moth families portions of this website, otherwise you will be potentially dealing with hundreds of names and pictures.

The photo gallery is divided into five sections. Section I is a gallery of moth images, each image is linked to an information page for that species. Section II is a gallery of larvae, again each is linked to an information page. Section III. is a roster of species information pages completed as part of *Moths of North Dakota*. Each name is a link to its information page. Section IV allows one to jump to a particular portion of the gallery, and Section V is a roster of common and Economically important moths, again with links to their particular information pages.

Moth Images 

Larvae Images 

Species List 

Images by Family 

Pest species & Common moths 

http://www.ndsu.nodak.edu/ndsu/ndmoths/home.htm

Moths of North Dakota Noctuidae: Noctuinae: Agrotini

Euxoa auxiliaris (Grote 1873)

Common name: Army cutworm

Hodges #: 10731.

Identification: Rfw 19.1 mm, a polychromic species– see illustrations, fw narrower than most other cutworm moths (wing shape similar to 10924), antemedial line 'zig-zag' extending as far out on A_{1+2} as tip of claviform spot; hw under good light with pink reflection as in 10915; male harpe very short and rounded, sacculus extension angled upward and spatulate at apex.

Similar species: 10723, 10730, 10801.

Distribution: northern Canada to northern Mexico and from the Pacific coast to the Great Lakes region, Missouri, and Texas.

Hosts: Larvae are cutworms on a variety of crops and are economically important on varieties of wheat, oats, and barley. Natural hosts are members of the Poaceae– grasses.

Note: This species is migratory, flying into the Rockies in early summer and aestivating at high elevations, moving back on to the plains in fall for egg laying.

SD, Minnehaha Co., Sioux Falls, 20- VI- 1976, yd. lt. coll. G. Fauske.

ND, Cass Co., Fargo. 13- V- 1956, UV lt. trap.

SD, Minnehaha Co., Sioux Falls, 21- VI- 1985, UV lt. trap, coll. G. Fauske.

Life Cycle of Cutworm

One generation per year

Overwinter as partial mature larvae or eggs

Cutworm Damage

- Larvae = Chewing mouthparts
- Destroy more of plant than eat
- Injury plants in 4 major ways:
  - Solitary surface cutworms
    - Black, Bronzed, Clay-backed, Dingy cutworms
  - Climbing species
    - Variegated, spotted, W-marked cutworms
  - Subterranean species
    - Pale western and glassy cutworms
  - “Marching” in great numbers
    - Army cutworms

Field Scouting

- **Pheromone traps for adults**
  - Army cutworm
  - Pale Western cutworm
  - Black cutworm
  - Western bean cutworm
- **Field sampling for larvae**
  - Trowel
  - Dig under soil and freshly cut plants
  - Active feeding at night

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Insecticide Recommendations

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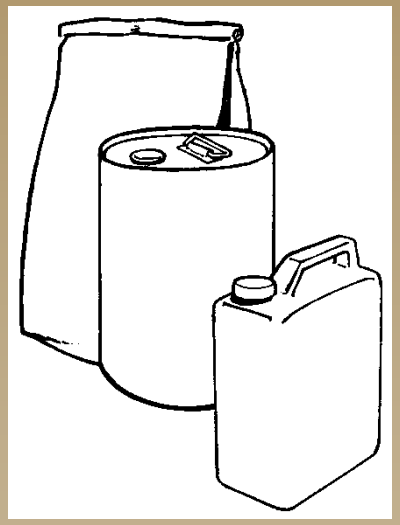

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Carbamates

- Carbaryl (Sevin)

Biorationals

- Azadirachtin (Aza-Direct, Azatin XL, Ecozin)
- Botanical oils (Ecotrol EC)
- Bt (Dipel ES)

* Restricted use pesticide

Insecticide Recommendations (continued)

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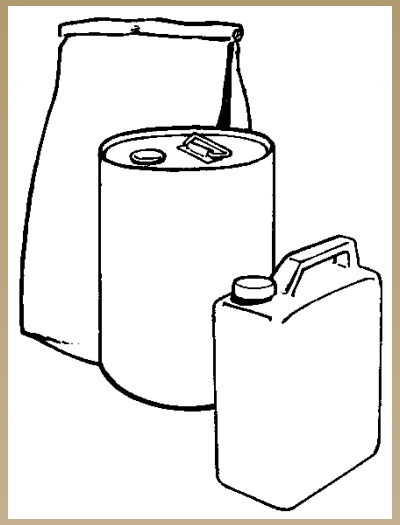

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