Chapter 21
Inhibition of Dihydropteroate (DHP) Synthase

1. General Information

Asulam (Asulox, Asulam) is the herbicide representing this mode of action. Asulam is a carbamate herbicide with a sulfonyl group and is a derivative of carbamic acid.

2. Primary Mode of Action

The mechanism of action of asulam is not well understood. Two mechanisms are proposed. The first and primary one is that asulam inhibits 7,8-dihydropteroate (DHP) synthase, an enzyme involved in folic acid synthesis. Folic acid is needed for transferring methyl groups in the synthesis of purines, pyrimidines, and some amino acids.

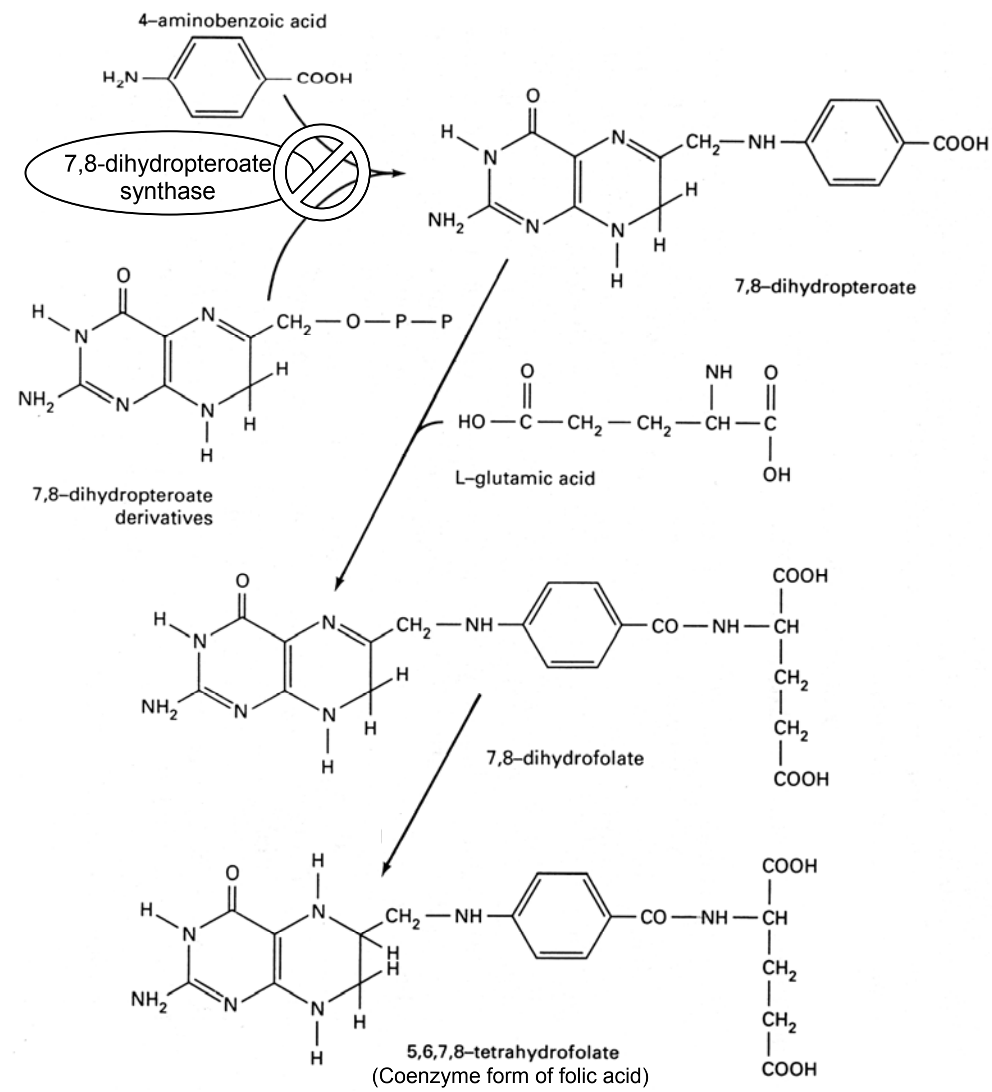
Specifically, asulam inhibits enzyme activity blocking the conversion of 4-aminobenzoic acid plus 7,8-dihydropteroate derivatives to 7,8-dihydropteroate. Therefore, other compounds further down the reaction series are also not produced to include folic acid and others. Tetrahydrofolate is the coenzyme form of folic acid. See figure on following page.

3. Secondary Mode of Action

Asulam also appears to be a mitotic inhibitor, presumably preventing microtubule assembly and/or function in meristematic tissues (See mitotic inhibitors handout for details).

4. Site of Action

The site of action is not definite. Microtubule assemblies during mitosis and in the cytoplasm at the site of purine synthesis have been proposed.

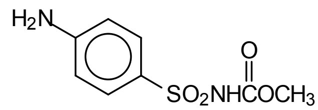


Source: Physiology of Herbicide Action. M.D. Devine, S.O. Devine, C. Fedtke. 1993. Prentice Hall, NJ.

5. Symptoms

- chlorosis in young weeds
- plant stunting followed by necrosis
- growing points usually killed 1 to 2 weeks after treatment whereas mature leaves senesce more slowly

6. Herbicide Family

<table>
<tr><td colspan="3">Carbamates</td></tr>
<tr><td>Example</td><td>
asulam (Asulox/Asulam)</td><td>carbamates are derivatives of carbamic acid; asulam is a sulfonylcarbamate with a sulfonyl group bonding a phenyl ring to the N of the carbamate nucleus; note similarity in structure to other carbamates: barban and others (pg. 80) and the phenyl carbamates (pg. 56); also note similarity in structure to sulfonylureas (pg. 100), <u>note</u>: there is only one O in the SU's vs. two O's in asulam</td></tr>
<tr><td>Metabolism</td><td colspan="2"><u>plant</u> – metabolized in tolerant plants; <u>soil</u> – microbial
half-life – asulam 7d</td></tr>
<tr><td>Absorption & Translocation</td><td colspan="2">readily absorbed by foliage when applied POST, less so by roots when soil applied; translocated in both xylem and phloem to growing points; absorption increased by wetting agents or oil adjuvant and decreased by low temperature and humidity</td></tr>
<tr><td>Selectivity</td><td colspan="2">selective – rapid metabolic degradation by tolerant plants and failure of susceptible plants to do the same</td></tr>
<tr><td>Herbicide Use</td><td colspan="2">controls annual and perennial grass weeds and some perennial ferns (bracken fern); used POST in sugarcane, pastures, forest sites, alfalfa, flax, chicory, poppies, Christmas tree plantings, St. Augustine, bermudagrass, ornamentals (junipers and yews), noncropland
extensive research conducted with asulam in Louisiana; rainfastness, adjuvants, uptake/translocation, interaction with fertilizer application, etc.
"consistently inconsistent herbicide"</td></tr>
</table>

7. General Comments

The herbicidal properties of asulam were first reported in 1965 by May & Baker.

Asulam is used extensively in sugarcane in Louisiana for johnsongrass control. Our data suggests that control is inconsistent and in many years control may be no more than 80%.

Often two applications are needed to control rhizome johnsongrass. Rainfastness studies have shown that 8 to 20 hours of a rain-free period are needed following asulam application to maximize control.

In contrast to asulam, the other carbamate herbicides barban, propham, and chlorpropham are mitosis disruptors. These herbicides, however, are no longer labeled.

8. References

Ahrens, W. Herbicide Handbook, seventh edition. 1994. Weed Science Society of America, Champaign, IL.

Devine, M.D., S.O. Duke, and C. Fedtke. Physiology of Herbicide Action. 1993. Prentice Hall, NJ.

Stryer, L. Biochemistry – fourth edition. 1995. W.H. Freeman, NY.