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OKLAHOMA COOPERATIVE EXTENSION SERVICE

# Current Report

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# Weed Control in Vegetables - 2002

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Weeds affect farm profits in several ways. When not controlled, weeds reduce crop yield and quality. When a crop is free of weeds, it is because the farmer has spent time and money to control them. An ideal practice would be planting crops in fields not infested with weeds. However, such fields are not found unless a farmer has taken extreme measures to keep weeds controlled over a number of years. It is not practical to keep crop production fields entirely weed free. However, by using careful management, weed infestations can be kept at low levels that make weed control easier when a field is cropped. Weeds can be kept at low levels by eliminating weed growth in fields while in fallow, after a crop has been harvested, or when not in use for any other reason.

While a field is being cropped, weeds are usually controlled by a combination of chemical, mechanical, or cultural practices. The choice of practices used will depend on the crop, weeds, and the production system in question. Controlling weeds with herbicides in vegetable crops is complex because of the large variation in crops, planting depths and methods, and the numerous weeds that are a problem. No one herbicide will control all weeds in a vegetable crop. The information on the label determines which weeds a herbicide has the potential for controlling.

Herbicides are not a practical method of weed control in a small home vegetable garden where several crops will be grown in a small area. Mulching, hoeing, and hand weeding are more practical. See Fact Sheet F-6005, "Mulching Vegetable Garden Soils" and F-6015, "Weed Control in the Home Garden."

No one method of weed control works best under all conditions. Preparation of seedbeds will kill existing weeds and provide favorable conditions for germination and early growth of crops. Vigorously growing crops provide effective shading to suppress weed growth later in the season. Herbicides should be used along with tillage and other crop management practices to control weeds that may compete with the vegetables. The planting time of the crop and effective management practices for optimum growth are important for maximum herbicide effectiveness with minimum crop injury. For information on varieties, time of planting, and fertility suggestions see Fact Sheets F-6000, F-6004, F-6007, F-6009, F-6032, and F-6035. These may be accessed on the Internet at **http://agweb.okstate.edu/pearl/** or **lane-ag.org.** Additional websites with label information include:

**http://www.greenbook.net/asp/Free.asp**
**http://kellysolutions.com/ok/pesticideindex.htm**
**http://www.cdms.net/pfa/1updatemsg.asp**

The number of herbicides used in most vegetable crops is less than with other agronomic crops. This is because the small seed size of many vegetables dictates a shallow depth of planting. Shallow planted seeds are more likely to receive herbicide levels high enough to cause injury than seeds that can be planted deeper.

## Herbicide Selection

Several herbicides have been found effective and relatively safe for use in vegetable crops. They are listed in the table on page 3. There are other herbicides approved for use in some crops that are not listed here. Many of the herbicides listed in the table have been tested in Oklahoma and surrounding states, and they have been effective. The amount of herbicide to use is not given in this table. Detailed information about the rate and method of use is explained on the label and should be consulted prior to use.

There are several factors that are important in selecting and using herbicides:

(1) The choice of a herbicide or herbicides for a weed control program depends on the crop being grown, the expected weed infestation, the equipment required for adequate application, the length of weed control desired, the cropping sequence, and the cost.

(2) Read the label for precautions, limitations, and directions for use. Use only a herbicide that has been registered for use on the crop to be grown.

(3) If you are trying a herbicide for the first time, it is advisable to do so on a small area. This is often referred to as a *trial use* in Extension Service publications.

(4) Apply at the rate suggested for your soil type and for the stage of crop or weed growth. Apply uniformly over the treated area. Accurate calibration of equipment is necessary to obtain the desired rate of application. See Fact Sheets F-1215, F-1216, and F-1217 on sprayer use and calibration.

(5) Application time is important with herbicides. *Preplant herbicides* are applied before a crop is planted. Often these are mixed (incorporated) with the top 1 $^{1}/_{2}$ to 2 inches of soil. *Preemergence herbicides* are applied after planting and before crop and weed seeds germinate to kill weeds as they germinate. They

should be applied to a well-prepared and weed-free soil for effective control. *Postemergence herbicides* are applied to young growing weeds. Herbicides approved for *pre-transplanting* applications are usually mixed with the soil before transplanting. *Post-transplanting herbicides* are applied after the plants are transplanted. Some chemicals are approved only after the plants are established, whereas others can be applied immediately after transplanting the crop. Many post-transplanting and postemergence herbicide applications must be directed away from the crop foliage to prevent injury. A few herbicides are approved for use only at certain times of crop growth such as post-harvest or at the time of certain tillage operations such as time of drag-off in potatoes or at lay-by when vine crops have three to five true leaves.

The term "stale seedbed" planting is becoming more common. In this method, the final seedbed is prepared 4 to 6 weeks prior to planting. Emerged weeds are killed with nonselective herbicides (e.g., GramoxoneMax and Roundup) before, during, or after planting but prior to crop emergence. The planting operation is done with minimal soil disturbance. Check labels for clearance.

(6) Always check the label for rotation restrictions prior to application of herbicides. The herbicides that can be used without injury to the next crop may be limited or not available. Some herbicides remain in the soil long enough to injure certain crops up to two years after application. Cropping sequence can play an important role in choosing a herbicide program. When using newly acquired land, be certain to check on prior herbicide use to prevent crop damage from carry-over.

## Discussion of Herbicides

Certain herbicides are classified as "restricted use" pesticides and a certified applicators license is required to purchase and use them. GramoxoneMax and various products containing atrazine are restricted use pesticides. GramoxoneMax, a contact herbicide, is approved for use in several vegetable crops. A contact herbicide will kill most vegetation it touches. It is important to use enough water to thoroughly wet the foliage that is sprayed. A contact herbicide is used to control small emerged weeds, usually before the crop is planted, or after planting but before the crop comes up. It does not control weeds that germinate after it is applied. Therefore, it is necessary to apply a preemergence herbicide in addition to a contact herbicide to control weeds that germinate later. Sometimes these are applied together.

Some preplant herbicides, such as Treflan or Prefar, will escape if not incorporated soon after application. Immediate sprinkler irrigation after application can be used instead of incorporation for some of these herbicides. When sprinkler irrigation is available some herbicides that are normally applied preplant and incorporated can instead be applied after planting. Check the label for approval before considering this alternative. If incorporation is used, it is important to do a good job of mixing the herbicide with the soil immediately after an even application of the herbicide. Check the label for proper incorporation depth. Use any tool that will do a good job of mixing the herbicide with the soil to the desired depth. This usually requires going over the field twice with a tillage tool, the second time at right angles to the direction traveled the first time.

Use of preemergence herbicides requires moisture soon after application to activate the chemical. When rainfall does not occur soon after application and sprinkler irrigation is available, a light irrigation will activate the chemical. If weeds appear after herbicide application, a light cultivation will kill small weed seedlings. It may also help activate the herbicide to kill later germinating weeds.

Some herbicide manufacturers are electing to drop various crops from their product's labels. Before a new container of herbicide is purchased always check the label for the target crop. If the crop is not listed on the label, that product or formulation cannot be legally used. Certain herbicides and defoliants are marketed by more than one company using different product names. User instructions for different brands may vary. Users should read labels carefully before changing brands.

## Asparagus

The herbicides listed for use in asparagus are used in different situations. GramoxoneMax can be used for direct seeded asparagus in crown beds or in field seeding. GramoxoneMax is used prior to, during, and after planting, but before asparagus seedling emergence.

Karmex and Sencor are preemergence type herbicides that can be used in spring before harvest. Karmex can also be used after harvest. Follow the label for rate information when two applications of Karmex are used in one season. They must be applied to a weed free soil for effective control. Do not use herbicides on newly planted crowns.

Poast and Fusilade are translocated herbicides approved for postemergence control of grasses in asparagus. When Fusilade is used, spears may not be harvested within a year of application. Good growing conditions for the grasses at application time are important for effective control.

The amine form of 2,4-D can be used to control broadleaf weeds but will not control grasses. This herbicide should be used with drop nozzles to keep the spray off the asparagus plants. It is very important to follow directions closely so that drift will not reach surrounding vegetables or other crops.

Roundup can be used before harvest or immediately after the last harvest to control emerged annual and perennial weeds. If Roundup is used during fern growth, it should be applied as a directed or shielded spray in order to avoid contact of the spray with ferns, stems and spears.

Additional herbicides labeled for use in asparagus that are not shown in the Herbicide Table include Banvel (dicamba), Clarity (dicamba), Stinger (clopyralid), Solicam (norflurazon), Sinbar (terbacil), Touchdown (sulfosate), and Reglone for site preparation prior to planting.

## Beans and Peas

Several preplant and preemergence herbicides can be used in beans or peas. Selectivity of these crops is better with many herbicides than vegetables with small seeds because these larger seeds can be planted deeper. The choice of which herbicide to use depends primarily on the weed problems and methods of application that fit the user's situation. Since there are several types of beans and

# Vegetable Crop Selective Herbicide Table

## Time of Use in Vegetable Crops*

| HERBICIDE | Asparagus** | Beans | Beets | Carrots | Cole Crops | Cucurbits | Eggplant | Greens | Lettuce | Okra | Onion** | Peas | Pepper | Potato** | Spinach | Sweet Corn** | Sweet Potato | Tomato |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Assure II (quizalofop) | | 5 | | | | | | | | | | 5 | | | | | | |
| Balan (benefin) | | | | | | | | | 1 | | | | | | | | | |
| Basagran (bentazon) | | 5 | | | | | | | | | | 5 | | | | 5 | | |
| Command (clomazone) | | 2 | | | 1 | 1, 2 | | | | | | 1 | 1, 2 | | | | 1, 2 | |
| Dacthal (DCPA) | | 2 | | | 1, 2 | 5 | 4, 5 | 2 | | | 2, 8 | 1, 2 | 5 | 2, 5 | | | 1, 2 | 5 |
| DeFol 6 (sodium chlorate) | | 9 | | | | | | | | | | 9 | | 9 | | | | |
| Devrinol (napropamide) | 5 | | | | 1, 2, 4 | | 3 | | | | | | 1, 3 | | | | 4 | 1, 3 |
| 2, 4-D amine | 7 | | | | | | | | | | | | | | | 2, 5 | | |
| Dual Magnum (s-metolachlor) | | 1, 2 | | | | | | | | | | 1, 2 | | 1, 6 | | 1, 2, 5 | | |
| Eptam (EPTC) | | 1, 8 | | | | | | | | | | | | 1, 6, 8 | | 1 | | |
| Frontier | | 1, 2, 5 | | | | | | | | | | | | | | 1, 2, 5 | | |
| Fusilade (fluazifop-butyl) | 5 | | | 5 | | | | | 5 | | 5 | | | | | | 5 | |
| Goal (oxyfluorfen) | | | | | 3 | | | | | | 5 | | | | | | | |
| Kerb (pronamide) | | | | | | | | | 1, 2, 5 | | | | | | | | | |
| Lasso, Partner or Microtech (alachlor) | | 1 | | | | | | | | | | | | | | 1, 2 | | |
| Lorox (linuron) | 1, 5 | | | 2, 5 | | | | | | | | | | 6 | | 5 | | |
| Poast (sethoxydim) | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | | 5 | 5 | 5 | 5 | 5 | | 5 | 5 |
| Prefar (bensulide) | | | | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | | 1, 2 | | 1, 2 | | | | | |
| Prism/Select (Clethodim) | | 5 | 5 | 5 | | 5 | 5 | | | | 5 | | 5 | 5 | | | 5 | 5 |
| Prowl (pendimethalin) | | 1 | | | | | | | | | 5 | 1 | | 2,6 | | | | |
| Pyramin (pyrazon) | | | 2,5 | | | | | | | | | | | | | | | |
| Ro-Neet (cycloate) | | | 1, 2 | | | | | | | | | | | | 1, 2 | | | |
| Lexone or | | | | | | | | | | | | | | | | | | |
| Sencor (metribuzin) | 2 | | | 5 | | | | | | | | | | 2,5,6 | | | | 1,5 |
| Sandea (Halosulfuron) | | | | | | 2, 5 | | | | | | | | | | | | |
| Sonalan (ethalfluralin) | | 1 | | | | | | | | | | 1 | | | | | | |
| Spin-Aid (phenmedipham) | | | 5 | | | | | | | | | | | | 5 | | | |
| Treflan (trifluralin) | 2, 7 | 1 | | 1 | 1,3 | 8 | 1 | 1 | 1 | 1 | | 1 | 3 | 6 | | | | 3,8 |

*Numbers in the table indicate time of use of herbicides as follows:
1. Application prior to planting. Some are incorporated into the soil
2. Preemergence application.
3. Application prior to transplanting
4. Apply herbicide after transplanting crop-sometimes as directed application
5. Postemergence application. Sometimes to weed-free soil or as a directed spray.
6. Application at time of dragroff.
7. Post-harvest and/or prior to harvesting
8. Lay-by, sometimes as directed application.
9. Harvest Aid.

** Additional herbicides approved for use in asparagus, onion, potato, sweet corn, or tomato are listed in the discussion.

"The pesticide information presented in this publication was current with federal and state regulations at the time of printing. The user is responsible for determining that intended use is consistent with the label of the product being used. Use pesticides safely. Read and follow label directions."

## Use and Timing of Non-Selective Herbicides for Vegetable Crops

**Time of Use in Vegetable Crops***

| HERBICIDE | Asparagus** | Beans | Beets | Carrots | Cole Crops | Cucurbits | Eggplant | Greens | Lettuce | Okra | Onion** | Peas | Pepper | Potato** | Spinach | Sweet Corn** | Sweet Potato | Tomato |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GramoxoneMax (paraquat) | 1, 2 | 1, 2 | | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | | 1, 2 | 1, 2 | 1, 2 | 1, 2, 9 | | 1, 2, 5 | | 1, 2, 5 |
| Reglone (diquat) | 1 | | | | | | | | | | | | | 9 | | | | |
| Rely (glufosinate) | | | | | | | | | | | | | | 9 | | | | |
| Roundup (glyphosate) | 7, 8 | 2 | 2 | 2 | 2,3 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1, 2 | 2 | 1 |
| Scythe (pelargonic acid) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Touchdown (glyphosatediamnonium) | 1, 2 | 1, 2 | | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 |

*Numbers in the table indicate time of use of herbicides as follows:
1. Application prior to planting. Some are incorporated into the soil
2. Preemergence application.
3. Application prior to transplanting
4. Apply herbicide after transplanting crop-sometimes as directed application
5. Postemergence application. Sometimes to weed-free soil or as a directed spray.
6. Application at time of dragroff.
7. Post-harvest and/or prior to harvesting
8. Lay-by, sometimes as directed application.
9. Harvest Aid.

** Additional herbicides approved for use in asparagus, onion, potato, sweet corn, or tomato are listed in the discussion.

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peas, be sure to check the label before using a herbicide to determine if it is approved for the type of beans or peas that you are growing. Additional herbicides labeled for beans that are not shown in the herbicide table include Pursuit, Rezult, and Prism.

## Bulb Onion

For onions direct-seeded in September, herbicides applied during the fall should be used initially on a trial basis. Use Prefar at the lowest recommended rate to minimize crop stunting. Control grass weeds with postemergence herbicides. Freezing temperatures will kill many annual weeds that emerge with the crop. Weed management will require the use of cultivation in addition to herbicides.

For transplanted onion, Prowl applied when onions have two to nine true leaves will control many annual grass and broadleaf weeds. Use postemergence herbicides on an as-needed basis and apply when weeds are at the proper size.

Additional herbicide labeled for use in onion not shown in the Herbicide Table includes Buctril (bromoxynil).

## Cole Crops

Cole crops for which herbicides listed in the table are approved are broccoli, cabbage, and cauliflower. If other cole crops are grown, be sure to check the label for approval before using any of these herbicides.

## Cucurbits

The vine crops most often discussed are cantaloupe, cucumber, squash, pumpkin, and watermelon. Some of the products listed in this publication cannot be used on all five crops. Some of the herbicides have special instructions of use on the label for vine crops that do not apply to any other crop. Alanap is used for control of some broadleaf weeds, whereas Prefar provides annual grass control. Curbit and Strategy will control annual grass and small-seed broadleafs and is applied preemergence. Treflan is effective when applied at the three to five leaf stage and immediately incorporated with cultivation. Check labels for crop injury hazards. Vine crops usually require a combination of herbicides and cultivation for successful weed control.

## Greens

The crops included in this category are mustard, turnip, collard, and kale. Spinach is listed separately in the table since most of the herbicides approved for use in other greens cannot be used in spinach. If other greens are grown, be sure to check the label for approval before using one of these herbicides. The rate suggested for many herbicides for greens is lower than those that can be used with the same herbicides for many other crops. Note that Treflan is not labeled for turnip roots.

## Irish Potatoes

There are several preplant and preemergence herbicides that can be used for weed control in potatoes. Most of these herbicides are approved for use at the time of drag-off. The process of dragging off the top of the soil kills any germinated weeds. A herbicide applied at that time acts as a preemergence herbicide to kill weeds that

## Herbicide Descriptions

| *Common name* | *Trade name* | *Major manufacturers* |
|---|---|---|
| 2, 4-D amine | AgriSolutions Amine 4, Savage | Agriliance, Platte |
| Alachlor | Lasso, Microtech, Partner | Monsanto |
| Ametryn | Evik | Syngenta |
| Atrazine | Aatres, Atrazine | Syngenta |
| Benefin | Balan | Platte |
| Bensulide | Prefar | Gowan |
| Bentazon | Basagran | BASF |
| Bentazon + Sethoxydim | Rezult | BASF |
| Bromoxynil | Buctril, Broclean, Bromax, Moxy | Aventis |
| Butylate | Sutan | Cedar |
| Carfentrazone | Aim | 'FMC |
| Chloridazon | Pyramin | BASF |
| Clethodim | Prism, Select | Valent |
| Clomazone | Command 3 ME & 4 EC | United Ag Products |
| Clopyralid | Stinger | Dow AgroSciences |
| Cycloate | RO-NEET | Cedar |
| DCPA | Dacthal | AMVAC |
| Dicamba | Banvel, Clarity, Sterling | Micro Flo, BASF, Agriliance |
| Dimethenamid | Frontier | BASF |
| Diquat | Reglone | Syngenta |
| Diuron | Karmex | Griffin |
| EPTC | Eptam, Eradicane | Syngenta |
| Ethalfluralin | Curbit | Platte, Dow AgroSciences |
| Fluazifop-butyl | Fusilade | Syngenta |
| Glyphosate | Roundup, Credit, Gly-Flo, Glyfos, Glyphomax, Honcho, Mirage, Rattler, Silhouette | Monsanto, Nufarm, DuPont, Micro Flo, Cheminova, Dow AgroSciences, Helena, Platte |
| Glyphosate-diammonium | Touchdown | Syngenta |
| Halosulfuron-methyl | Sandea | Gowan |
| Imazethapyr | Pursuit | BASF |
| Linuron | Lorox | Griffin |
| Metribuzin | Lexone, Sencor | Bayer |
| Napropamide | Devrinol | United Phosphorus |
| Naptalam | Alanap | Uniroyal |
| Norflurazon | Solicam | Syngenta |
| Oxyfluorfen | Goal, Galigan | Dow AgroSciences |
| Paraquat | Gramoxone Extra, Boa, Cyclone | Syngenta |
| Pebulate | Tillam | Cedar |
| Pelargonic acid | Scythe | Mycogen |
| Pendimethalin | Prowl, Pendimax | BASF |
| Phenmedipham | Spin-Aid | Aventis |
| Pronamide | Kerb | Dow AgroSciences |
| Quizalofop | Assure II | DuPont |
| Rimsulfuron | Matrix, Shadeout | DuPont |
| Sethoxydim | Poast | BASF |
| Simazine | Princep, Caliber 90, Sim-Trol | Syngenta |
| S-Metolachlor | Dual Magnum | Syngenta |
| Sodium chlorate | DeFol 6 | Drexel |
| Terbacil | Sinbar | DuPont |
| Trifluralin | Treflan, Trilin, Trust | Dow AgroSciences, Griffin, Agriliance |

germinate later. If the same herbicide had been applied before this time, it probably would be ineffective because it would be diluted and scattered with the drag-off operation.

GramoxoneMax can be used to kill seedling weeds that germinate before the crop comes up or kill weeds that germinate before preemergence herbicides are activated.

Additional herbicides labeled for use in potatoes that are not shown in the Herbicide Table include Matrix (rimsulfuron), Turbo (premix of metolachlor and metribuzin) and Vapam (metam-sodium).

## Sweet Corn

Most herbicides that control weeds for a long time in sweet corn are different from those that are used in other vegetables.

Sutan (butylate) is a short residual herbicide that can be incorporated in preplanting for the control of grasses. It does not last long enough in the soil to carry into later crops. It must be incorporated immediately after application for effective control.

Dual will control many grasses and several species of broadleaf weeds. Dual is a short residual herbicide and can be lightly incorporated in preplanting or used in preemergence applications.

Atrazine (several brands) gives excellent control of many broadleaf weeds, but lasts a long time in the soil. Use Atrazine in areas where only corn or sorghum will be planted within 18 months after application.

A postemergence herbicide like 2,4-D, or Aim controls only broadleaf weeds, while Sempra controls nutsedge and shome broadleaf weeds. The growth stage of corn at time of application is an important factor. Late applications may not be effective, and early or late applications may result in corn injury. There are several corn herbicide products that are mixtures of two different active ingredients and provide broader spectrum weed control in a single package. Some of these include Bicep, Bullet, Guardsman, Leadoff, Laddock, Simazat, and Surfire.

## Tomatoes and Peppers

There are several herbicides that can be used in tomatoes and peppers. All preplant and preemergence residual herbicides listed in the table control annual grasses better than broadleaf weeds. It is important to check the instructions on the label to determine whether to use these herbicides for direct seeded beds or transplants. Small seedling plants that germinate near the soil surface would be much easier to injure with herbicides than plants large enough to transplant.

Additional herbicides labeled for use in tomatoes that are not shown in the Herbicide Table include Shadeout (rimsulfuron) and Tillam (pebulate).

# The Oklahoma Cooperative Extension Service
# Bringing the University to You!

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.



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