Purdue Cooperative Extension Service
USDA-NIFA Extension IPM Grant

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In This Issue

Insects, Mites, And Nematodes

Just the Facts Ma'am: Effects of a Mild Winter on Insect Populations - (*Christian Krupke and John Obermeyer*)

- Comprehensive studies of insect mortality ("life tables") reveal generally minor effect from winter temperatures, cold or warm.
- Natural enemies, especially pathogens, cause tremendous mortality to insects when they are in abundance.
- Many of our resident insect pest populations have been unimpressive the last few years… not much material to work with for population explosions.
- Just as with every year, there are surprises yet to be experienced in 2012…stay tuned to future *Pest&Crop* issues.

In recent weeks there has been a flurry of articles in extension publications and the popular press about the direct relationship of warmer winter temperatures and greater insect densities for the coming season. These are largely educated guesses on our part, but at the same time, we do ponder these things, especially with forecasted temperatures in the mid to upper 70s all this coming week. Though much like forecasting weather, there are unforeseen circumstances that cause insect populations to flourish or flounder. In other words… sometimes nobody really knows what will happen. Consider a few insect basics…

Bean leaf beetle overwintering under field-side residues

Mortality: Though it is hard to imagine, insects constantly struggle to survive. Insect's natural mortality is generally far greater than 70% between egg and adult. Life tables have been developed for many insect species to more thoroughly understand them. Most mortality happens early: egg infertility, and the inability of newly hatched larvae to establish on their host (due to rain events, desiccation, etc.) cause considerable mortality. Even insects bred in environmentally controlled laboratory conditions may still have mortalities of 50% or greater. Interestingly, for overwintering insects in Indiana, death from freezing is infrequent. A large number of freeze/thaw cycles in a given winter can cause problems, simply by exposing insects to a range of conditions and making it difficult to adjust in time. The highest percentage succumb because they are an important source of food, specifically for other insects and birds, rodents etc. Which leads us to…

Predation/Parasitism/Disease. It really is a "bug eat bug world." As overwintering pest insects become active, so do their natural enemies. There is a plethora of bug (insect and insect related) generalists and specialists that feast on any/or all life stages of insects. Some soil predators, such as ground beetles, use mouthparts with mandibles to capture and devour soft-bodied insects (eggs and larvae). Tiny parasitic wasps will soon begin their aerial assaults upon unsuspecting above-ground pests by laying their eggs inside of eggs and larvae. The wasp larvae will slowly eat the "insides" of the host (watch this video of a hornworm parasite <http://youtu.be/nZZyJQNmOV8>). Pathogens of pest insects, generally favored by warm and moist environments, may spread throughout an insect population while they overwinter or become mobile in the spring. These natural enemies too have likely survived the mild winter, but their increased densities are dependent on the next item, a food source…

In 1991, one of the highest European corn borer outbreaks in recent memory occurred. That fall we observed nearly 30% of the overwintering population diseased, like the one pictured. This fungal disease continued to impact 1992 corn borer numbers, to the point where they weren't an issue that season.

Beginning Populations: Biotic potential of insect/insect-like pests can make for a lively exercise in mathematics. Without going into gory details, most have experienced the amazing population surge of soybean aphid or two-spotted spider mites when conditions favor their reproduction and spread in a stressed crop. These "perfect storms" rarely occur, and predicting them is about as easy as predicting the weather. Insect pests that overwinter in the Midwest, subject to these mild winter conditions, are not breeding and ramping up their numbers for this spring. Because mating and egg laying take a tremendous toll on their energy reserves, it would be biological suicide for insects to emerge early, so they wait until freezes are past and food is available. In other words, the overwintering pest's numbers cannot increase over last year's densities. Many of our major corn/soybean pests were at very low populations going into the winter. An excellent example is corn rootworm, we've not seen this low of rootworm populations in decades. This has nothing to do with winter temperatures, it has a lot to do with wet soils in later May and early June the past several years (i.e., larval drowning). One exception to the low densities is bean leaf beetle, which have not been a pest of concern for many years, but were found in fairly high numbers last fall. These beetles overwinter here and will be re-emerging to colonize early-planted soybeans in this spring, so producers will want to keep an eye out for them. Another possible exception is the always-unpredictable soybean aphid. These overwinter as eggs on buckthorn buds, and are thus exposed to the elements. This Asian invader is still considered a relatively recent colonizer of North America (approximately 10 years), and is near the lower limit of its cold tolerance in a typical Indiana winter, so it is possible that egg mortality was lighter than usual during this past winter.

Wild Cards: What is predictable about insects is that they can't be predicted. This unknown factor with insects has troubled producers for generations, leading to some infamous environmental and social consequences in the past from excessive use of pesticides (e.g., Silent Spring). In short, trying to anticipate insect outbreaks is pointless, and only leads to unwarranted prophylactic treatments of pesticides. Don't make fear-based management decisions – get all the information possible before applying pesticides. Bear in mind that every corn kernel already has insecticide on it, and many include Bt traits that target key pests as well. In soybeans, most seeds are treated and there the list of pests is relatively short – the big one (soybean aphid) generally does not arrive to colonize in Indiana until later in the summer. Pest managers have many tools available to properly assess pest populations (e.g., pheromone trap reports, black light trap catches) as they progress throughout the season. This newsletter, with the help of countless volunteers, will do just that…keep you informed. Happy scouting!

Cover Crops: Termination with Herbicides and Insect Consideration – (*Travis Legleiter, Bill Johnson, and Christian Krupke*)

The benefits of cover crops are well advertised and accepted in the Midwest, but producers also need to be aware of the challenges that cover crops present. The successful incorporation of a cover crop into current crop rotations will require increased management, labor, and time that producers may lack or not be willing to forfeit for the benefits received. One of the unique challenges that cover crops present is the timely and successful termination of the cover crop.

Cover crop termination is typically achieved by a designed winter kill of the crop or a planned termination in the spring prior to the planting of a production crop. The majority of producers are going to use herbicides to terminate overwintering cover crops in the spring. The timing, herbicides, and rates of herbicide used to achieve cover crop termination are critical in achieving a successful kill.

Timing of a cover crop termination is important not only to the success of the cover crop system design, but also the herbicide efficacy on cover crops. Crops that are allowed to grow late into the spring harbor pest, maintain high soil moisture, and slow soil temperature increases that ultimately delay production crop planting. These crops will also become difficult to control, as larger more mature plants are less susceptible to herbicides. Crops that are terminated by chemical methods should be controlled as early in the spring as feasible and allowed by weather conditions, in order to achieve successful termination as well as preventing planting delays.

Cover crops that stay green late into the spring will attract insects and other pests that may need to be controlled, and will require additional crop scouting. A commitment to cover crops must include a commitment to scouting if it is to be successful. The most commonly found insects include the migratory pests black cutworm and armyworm (particularly common on annual ryegrass) – the females of both species are capable of migrating long distances and will deposit eggs in a wide range of hosts, but will particularly seek out plants that are well-established and growing well. This often describes cover crops. These caterpillars often reach high densities in the cover crop and will often move from the cover crop to the row crop if there is not a sufficient “host free period”.

This is the key to managing these insects in cover crops – a period of starvation. To decrease the chances of insect infestation, the cover crop should be killed at least 2 weeks prior to planting the row crop. Regrowth of the cover crop should be treated with an appropriate herbicide mixed with a pyrethroid insecticide. Because reinfestation and hatching of new eggs may occur after treatment, additional scouting for insects will still be needed at, and shortly after, plant emergence to determine whether further insecticide treatments are required.

Note that observing the 2 week window and starving any pests is far preferable to insecticide application for several reasons, including the fact that large caterpillars are often not effectively controlled by insecticide, and application of insecticides will kill any beneficial insects present in the cover crop, effectively negating one of the main benefits of the approach.

Herbicide products and rates to be used in a cover crop termination program will be dependent on the species and growth stage of the cover crop. Cereal Rye, crimson clover, and Austrian winter peas are a few cover crops that can be terminated with glyphosate products (Roundup WeatherMax, Touchdown, Buccaneer, etc.) at a 0.75 lb ae/A rate. Combinations of glyphosate plus 2,4-D, chlorimuron, chloransulam, atrazine, or saflufenacil will increase efficacy on mixed stands of the above-mentioned crops as well as add residual activity on summer annual weeds into the production crop. A cover crop that has gained popularity and that can be much more difficult to terminate is annual ryegrass. Annual ryegrass is also often referred to as common ryegrass and is recognized as the weedy species Italian ryegrass. The popularity of this species as a cover crop can be attributed to it’s competitive and aggressive nature, which are also traits that make it a troublesome weed in a variety of productions systems in the western and southern regions of the United States. Producers choosing to use annual ryegrass as a cover crop should use vigilant methods to assure complete termination and eliminate ryegrass seed contributions to the weed seed bank. Unfortunately, very little research data on annual ryegrass cover crop termination by chemical methods is currently available. The following guidelines should be followed to achieve the most successful termination of a ryegrass cover crop:

- Applications should be made to as small of plants as possible, preferably less than 8” in height and prior to jointing.
- A translocated non-selective herbicide such as glyphosate should be applied at an increased rate (Glyphosate-1.5 lb. ae/A).
- Herbicide efficacy on the cover crop should be monitored following application and additional methods of control initiated if complete death is not achieved.

Table 1. Response of annual ryegrass to corn and soybean burndown herbicides

Active Ingredient	Trade Name	Annual Ryegrass Control[a]
Atrazine	AAtrex	5
S-metolachlor+glyphosate	Sequence	6
Atrazine+S-metolachlor+glyphosate	Expert	6
Glyphosate	Roundup, Touchdown, etc.	7
Paraquat	Gramoxone	6
Fomesafen+glyphosate	Flexstar GT	7
Paraquat+atrazine[b]		7

* Control Scale: 8-9=Good, 6-7=Fair, 5-0=Poor.
[a]Annual ryegrass control numbers derived from University of Kentucky Weed Control Recommendations Guide. All herbicides applied at a standard rate typical for a corn or soybean burndown. To attain additional control producers should raise the herbicide rate to the maximum feasible labeled rate.
[b]Paraquat + atrazine is not available as a pre packaged herbicide, treatment listed is a tank mix at standard rates.

A cover crop termination extension publication covering in depth details of the above topic is currently in production and will be available online at the Purdue Extension Education Store in early April.

Spring Herbicide Applications on Winter Wheat – (*Travis Legleiter and Bill Johnson*)

The date on the calendar may indicate that we are still in the winter season, but the weather outside would indicate otherwise. The temperatures of the past winter have been mild especially throughout late February. The mild winter and early spring like conditions are not only favorable for a good wheat crop, but also for winter annual weeds. Winter annual weeds that occur in wheat fields over the winter will also be taking full advantage of the spring like conditions to get a jump-start to the season. Many wheat producers, especially in the southern regions of Indiana will soon be or already are topdressing need to also be scouting for weeds and determining if a herbicide application is necessary on any existing winter annual weeds. The following information will outline winter annual weeds for look out for, weed scouting tips, crop stage restrictions, and herbicide recommendations.

Some common broadleaf weeds to scout for in your winter wheat are dandelion, purple deadnettle, henbit, chickweed, Canada thistle, and wild garlic. These winter annual species that emerge in the fall can remain relatively inconspicuous though the winter and become competitive and troublesome during the spring if not controlled early in the spring. Summer annual weeds such as ragweed will be of less concern in the early spring and will be outcompeted by the wheat crop if managed properly, especially in the favorable conditions currently being experienced. Grass weeds to be aware of and scouting for are: annual bluegrass, annual ryegrass, cheat, and downy brome.

Determining the severity of weed infestations in your wheat fields is key in determining the necessity of a herbicide application. As with all agronomic crops, you should scout your entire field to determine what weed management practices need to be implemented and determine any areas of severe weed infestations. Wheat fields that contain uniform infestations of at least one broadleaf weed and/or three grass weeds per square foot should be taken into consideration for a herbicide application to avoid yield loss and

harvest interference problems. Some fields that have less uniform infestations, but rather pockets of severe infestation should be managed to reduce weed seed production and future infestations.

When determining your herbicide program for spring applications, the stage of the wheat crop should be considered. The majority of wheat herbicides are labeled for application at certain wheat growth stages and some commonly used herbicides have very short windows in which they can be applied. The popular broadleaf weed herbicides 2,4-d and MCPA are efficient and economical, but can only be applied for a short period of time between tillering and prior to jointing. This is a short window that occurs early in the spring and may occur even earlier this year if current weather conditions hold into the spring. Wheat growth stages and herbicide timing restriction are outlined in Figure 1.

If weed infestations are severe enough to require a herbicide application, the use of liquid nitrogen fertilizer solution as a carrier is a popular option for applying herbicides and topdressing the wheat crop in a single pass over the field. Caution should be taken when using a liquid fertilizer as a herbicide carrier as moderate to severe crop injury can result, especially in saturated conditions. Many post applied wheat herbicide labels allow for liquid nitrogen carriers, but require different rates and types surfactants than if the herbicide was applied with water as the carrier. Table 1 includes precautions to be taken when applying wheat herbicide using liquid fertilizer as a carrier; further details and directions can be acquired from the herbicide label.

Figure 1. Feeke's scale of winter wheat stages and herbicide application timings.

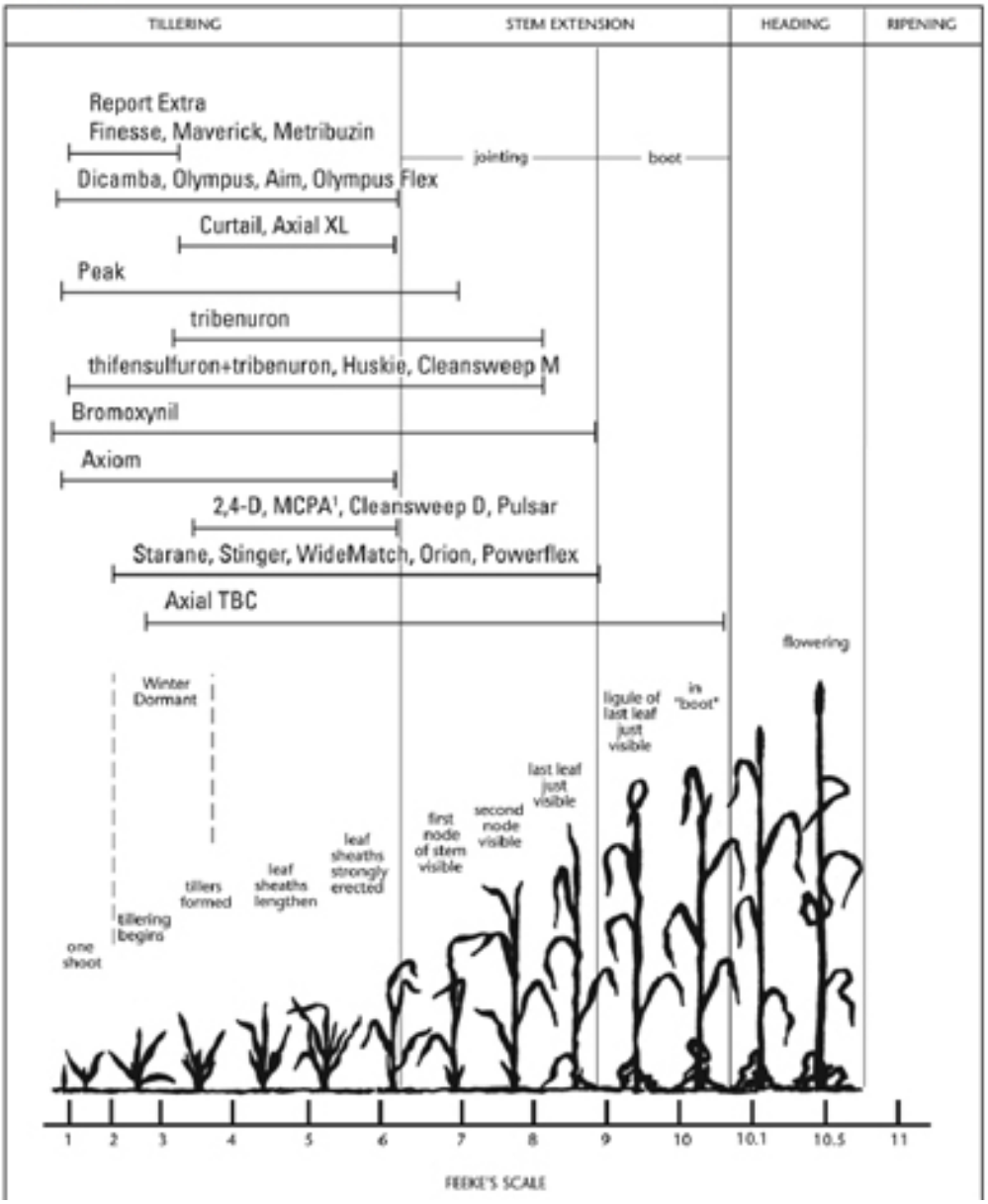

Table 1. Spring applied wheat herbicide rates, crop stage restrictions, weed control spectrum, soybean plant back timing, and liquid fertilizer carrier recommendations.

Active Ingredients	Trade Name(s)	Rate per Acre	Application Timing	Winter Annual Weeds Controlled	Liquid Fertilizer Carrier Recommendations	Soybean Plant Back Restriction
2,4-D	Weedar, Weedone, Formula 40, others	1 to 2 pts.	Tillering to before jointing	Prickly and wild lettuce, mustards, field pennycress, shepherd's purse, horseweed (marestail), Dandelion*	The use of a liquid fertilizer as a carrier will increase the risk of crop injury	No restriction for early spring applications
Bromoxynil	Buctril, Moxy	1 to 2 pts.	Emergence to boot stage	Mustards, henbit, field pennycress, shepherd's purse	UAN used as a carrier in early spring may increase leaf burn, do not use fertilizer carrier after jointing	No restriction for early spring applications
Bromoxynil+ pyrasulfotole	Huskie	13.5 to 15 oz.	After 1-leaf stage up to flag leaf emergence	Purple deadnettle, henbit, prickly and wild lettuce, horseweed (marestail), mustards, field pennycress, shepherds purse, chickweed	Can be applied in a liquid fertilizer solution that does not exceed 50% nitrogen and is not being applied above 30 lb./Acre	4 Months
Bromoxynil + fluroxypyr + 2,4-D	Cleansweep D	1 to 1.5 pts.	Tillering to before jointing	Henbit, horseweed (marestail), mustards, field pennycress, shepherds purse, Canada thistle		4 Months
Bromoxynil + fluroxypyr + MCPA	Cleansweep M	1 to 1.5 pts.	2-leaf to flag leaf emergence	Henbit, horseweed (marestail), mustards, field pennycress, shepherds purse, Canada thistle		4 Months
Clopyralid	Stinger	0.25 to 0.33 pts.	After 2-leaf stage until boot stage	Horseweed (marestail), Canada thistle, dandelion* prickly and wild lettuce		10.5 Months
Clopyralid + 2,4-D	Curtail	1 to 2.67 pts.	Tillering to jointing	Prickly and wild lettuce, mustards, field pennycress, shepherd's purse, Canada thistle, dandelion*, horseweed (marestail)	UAN can be used as a liquid fertilizer carrier	10.5 Months
Dicamba	Banvel	0.125 to 0.25 pt.	Emergence to before jointing	Prickly and wild lettuce, horseweed (marestail), shepherd's purse, dandelion*	Conduct compatibility test as outlined by label prior to application	No restriction for early spring applications

Table 1. (Continued)						
Active Ingredients	**Trade Name(s)**	**Rate per Acre**	**Application Timing**	**Winter Annual Weeds Controlled**	**Liquid Fertilizer Carrier Recommendations**	**Soybean Plant Back Restriction**
MCPA	Chiptox, Rhomene, Rhonox	1 to 4 pts.	Tillering to before jointing	Field pennycress, shepherd's purse, mustards, pigweed, prickly lettuce, horseweed (marestail)	The use of a liquid fertilizer as a carrier will increase the risk of crop injury	No restriction for early spring applications
Pinoxaden	Axial XL	16.4 oz.	2-leaf to preboot stage	Ryegrass	Can be applied in a liquid fertilizer solution that does not exceed 50% nitrogen fertilizer. Crop injury may be possible.	120 Days
Pinoxaden + fluroxypyr	Axial Star	16.4 oz.	2-leaf to preboot stage	Ryegrass	Can be applied in a liquid fertilizer solution that does not exceed 50% nitrogen fertilizer. Crop injury may be possible.	4 Months
Pinoxaden + florasulam	Axial TBC	8.85 oz.	3-leaf to boot stage	Ryegrass, chickweed, mustards, shepherd's purse	Can be applied in a liquid fertilizer solution that does not exceed 50% nitrogen fertilizer. Crop injury may be possible.	9 Months
Propoxycarbazone-sodium	Olympus	0.6 to 0.9 oz.	Emergence to before jointing	Cheat, downy brome, purple deadnettle, horseweed (marestail), mustards, field pennycress, shepherds purse	Maximum of 0.25% v/v NIS should be used when applying with a liquid fertilizer carrier. Temporary crop injury may occur.	12 Months and 24" of precipitation
Propoxycarbazone-sodium + mesosulfuron-methyl	Olympus Flex	3 to 3.5 oz.	1-leaf to before jointing	Cheat, downy brome, purple deadnettle, horseweed (marestail), mustards, field pennycress, shepherds purse, annual bluegrass, ryegrass	Maximum of 0.25% v/v NIS should be used when applying with a liquid fertilizer solution. Carrier solutions should not contain more than 15% nitrogen fertilizer.	5 Months and 18" of precipitation
Prosulfuron	Peak	0.5 oz.	Emergence to second node visible	Mustards, field pennycress, prickly and wild lettuce, shepherd's purse, wild garlic, wild onion	Apply with NIS at 1-2 qt./100gal when using a liquid fertilizer carrier.	10 Months

Table 1. (Continued)						
Active Ingredients	**Trade Name(s)**	**Rate per Acre**	**Application Timing**	**Winter Annual Weeds Controlled**	**Liquid Fertilizer Carrier Recommendations**	**Soybean Plant Back Restriction**
Pyroxsulam	PowerFlex	3.5 oz.	3-leaf to jointing	Cheat, downy brome, ryegrass, chickweed, mustards, field pennycress, shepherds purse	Can be applied in a liquid fertilizer solution that does not exceed 50% nitrogen and is not being applied above 30 lb/Acre. NIS at 0.25% v/v should be added to solution.	3 Months
Thifensulfuron + tribenuron	Harmony Extra TotalSol	0.45 to 0.9 oz.	After 2-leaf stage but before flag leaf becomes visible	Wild garlic and onion, field pennycress, mustards, chickweed, henbit shepherd's purse, prickly and wild lettuce, horseweed (marestail), purple deadnettle	Include a surfactant at 0.5-2 pts./100 gal when applying in a carrier that consist of less than 50% nitrogen fertilizer. Consult DuPont representative if carrier contains greater than 50% nitrogen fertilizer.	45 Days
Tribenuron	Express TotalSol	0.25 to 0.5 oz.	After 2-leaf stage but before flag leaf becomes visible	Chickweed, deadnettle, henbit, wild lettuce, mustards, field pennycress, shepherd's purse	Liquid fertilizer carriers should have 0.06-0.25% v/v NIS added. Temporary crop yellowing and stunting may occur when applied in liquid fertilizer. This injury is occasionally severe, and risk of sever injury may increase under saturated soil conditions.	45 Days
* The highest labeled herbicide rates should be used to achieve control of dandelion plants with spring applications.						

Bits & Pieces

2012 Popcorn Agri-Chemical Handbook - (*Genny Bertalmio, The Popcorn Board*)

The 2012 *Popcorn Agri-Chemical Handbook* is now available at <http://www.popcorn.org/handbook> to ensure everyone in the popcorn industry is informed about products registered for use on popcorn or in popcorn storage facilities. The handbook lists agri-chemicals registered, special use restrictions and the status of a chemical under special review by the Environmental Protection Agency (EPA). The International Maximum Residue Level (MRL) Database, <http://www.mrldatabase.com/> <http://www.mrldatabase.com/>, includes popcorn and denotes established levels by the US, Codex, EU and 80 markets.

The Popcorn Board urges you to provide the above links to your growers or download, print and distribute the updated version of this critical information to them. Contact Genny Bertalmio, +1.312.821.0217 or <gbertalmio@smithbucklin.com>, for further information or if you require a hard copy.

The Popcorn Board accepts voluntary contributions to ensure continued funding of its efforts to provide this important information to the popcorn industry. Checks should be mailed to: The Popcorn Board, 8333 Solutions Center, Chicago, IL 60677-8003.

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