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## **Product Comparison Files: Ethanol Defense® vs. Other Ethanol Fuel Treatments**

Bell Performance invented the first fuel additive in the year 1909 and has been formulating effective problem-solving fuel treatments ever since. In response to recent market demands for solutions to problems with ethanol-blended gasoline fuels, Bell Performance introduced Ethanol Defense® in 2011 as a sister product to its Mix-I-Go® multifunction gasoline treatment. In this document, we'll compare the important functions of ethanol gasoline fuel additives and see how some of the prominent options in the marketplace compare with Ethanol Defense®.

### **Introduction**

The widespread addition of ethanol to the gasoline supply is, arguably, the biggest fuels change to gasoline in the United States in the 21<sup>st</sup> century. Ethanol users across the spectrum have noted problems that are strongly linked to this. This has given rise to numerous fuel additives in response, all claiming similar benefits. Consumers do not have a clear idea which additive is better than another, nor do they really know what they should be looking for in the first place.

### **Ethanol Gasoline Additives – What They're Used For**

Consumers purchase fuel additives to treat ethanol fuel because they expect certain things. These expectations are informed by what they observe happening in their vehicles and small equipment when they put fuel in them. That fuel is probably an ethanol blend like E10 because that's the only kind of gasoline that is available to the majority of consumers at their local gas stations. These expectations are also informed, in no small part, by what they \*think\* they should be seeing, based on all the information they've seen, read and heard about the effects ethanol gasoline has in different applications.

Given that these consumers (whether business users or home users) are not petroleum experts, it's not surprising that they may not know what to believe when it comes to the treatment options available to them. More than a few fuel additive products prey on user ignorance, wowing them with broad promises that have little chance of being kept. The jilted consumer has no choice but to assume that fuel additives are all a waste of money. This paints the fuel additive industry with a broad brush of dishonesty, which is really unfortunate. There are ethanol fuel additives that do work and do fulfill their promises. So we want to compare and contrast the good, the bad and the ugly when it comes to ethanol fuel additives.

### **What To Look For In An Ethanol Fuel Additive**

The most important attributes of a good ethanol fuel additive are:

#### ***Provide detergency to clean injectors, combustion chambers and fuel system***

Injector cleaning is the single most important function a fuel additive can offer. Injector deposits directly affect a number of important links in the internal combustion chain, including the proper atomization of the fuel into the combustion chamber. Keeping the injectors, the combustion chamber and fuel system clean and free of deposits offers the greatest benefits toward improving vehicle/equipment performance and keeping them performing at a high level.



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### ***Improve mileage and power (within reason)***

The biggest complaint with ethanol fuels is the perceived lowering of gas mileage. This is the one consumers pay the most attention to. Ethanol itself has less energy content than petroleum gasoline, which lowers the maximum mileage a user can attain. There are legitimate ways to improve fuel efficiency and increase power in gasoline engines. These ways typically center around a combination of active ingredients that improve combustion of the fuel and change the conditions within the engine such that it functions closer to the level it was functioning at while it was new.

Overpromising on mileage improvement claims with ethanol fuels is a significant problem in the fuel additive industry. Improving mileage has a lot to do with the condition of the engine at the start – older, dirty engines have the greatest room for improvement, while new engines are difficult to achieve significant improvement on. It is reasonable for an ethanol fuel additive to talk about improving fuel mileage by 6-8% or more. Additives guaranteeing significant mileage improvements well into the double-digits (i.e. 18-19% or more) are not to be trusted.

### ***Removal of water and preventing phase separation***

Ethanol's ability to attract and absorb water is a major problem that leads to multiple costly problems. For business users, water presence in ethanol fuels contributes to corrosive storage tank damage over time. For both business and consumer users, excessive water absorption leads to phase separation of the ethanol fuel, which destroys the fuel quality and can render it unusable. A quality fuel additive for ethanol should improve the fuel's ability to tolerate water absorption and extend its ability to withstand phase separation. The fuel additive should be able to do both of these without using an alcohol constituent to execute the function. Lower quality fuel additives will add alcohol to their formulations to be able to make this claim, but this additional alcohol only further contributes to the overall problem ("you can't solve an alcohol problem with more alcohol").

### ***Protect against ethanol solvency damage and damage to 2-stroke engines***

Small equipment users have long complained about damage to their equipment linked to ethanol-blended gasoline. Exposure to ethanol gasoline over time leads to softening and damage of polymer parts (rubber and plastic) as the fuel dissolves the polymers. This can render the equipment inoperable. Other forms of damage linked to the action of ethanol gasoline include corrosion of carburetor parts and catastrophic damage to 2-stroke engines through ethanol's interference with fuel-oil lubrication. Given these serious concerns, a quality additive for ethanol should contain constituents that protect equipment parts from solvency damage and corrosion, while also protecting 2-stroke engines from any interference with lubrication by the fuel.

In addition to these functions, the following should also be true of a good ethanol fuel additive.

### ***Low Treat Rate (But Not Too Low)***

Treat rate directly determines how much a fuel additive costs to use. A single-treat additive might only cost \$5.00 a bottle, but if that bottle only treats one tank of fuel (15-20 gallons), the cost to use it would approach 30 cents per gallon. On the other hand, a concentrated multi-function additive might cost \$20.00 for a bottle treating 150 gallons or more. Its cost-to-treat is below 13 cents a gallon – less than half of the other one. Smart consumers will consider the cost-to-treat on a per-gallon of fuel basis, not the initial cost of the additive itself. It does not matter if a fuel additive turns straw into gold if its usage costs is more than you can afford to pay.



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### *EPA-Registered*

By law, all on-road fuel additives must be registered with the Fuel Additives division of the United States EPA. This includes re-labels and re-names of existing additives (of which, there are many). There's no requirement to put a registration statement on the product label, so you can't tell just by looking at that if the diesel fuel additive is EPA-registered. The full list of registered fuel additives, whether gasoline or diesel, can be found simply by googling "EPA list of registered fuel additives". If an on-road fuel additive is not EPA-registered, it's not legal to sell it in the United States.

That's to say nothing of whether the additive will actually work or not. An additive maker that hasn't taken the time to comply with the simple additive registration process (it's free) is not likely to be taking the time to formulate an additive that really works, whatever the additive's claims may be.

It is also important to keep in mind that EPA-registration does not mean that the EPA or the United States government is endorsing an additive or even that it works. EPA-registration is concerned with the contents of the formulation. They do not care what claims of greatness are made about it.

### *Backed By History*

Any time a business opportunity surfaces, you can bet the answers will come out of the woodwork. There are hundreds of "new entrants" into the fuel additive marketplace, all claiming to be the best. In the absence of evidence enabling the consumer to distinguish the good ones from the bad ones, it is a good idea to look for a robust company history backing up the product. It's easy to make a product, throw up a web site or Facebook page, maybe even manufacture some "testimonials". It's impossible to manufacture decades of successful business practice. An ethanol fuel additive backed by a long history of customer satisfaction is a lot more likely to be legitimate and worth your consideration.

## **Ethanol Defense® vs. The Marketplace Competition**

Now that we have a clearer picture of what separates good ethanol additives from ones of lesser quality, let's see how Ethanol Defense® from Bell Performance compares to some of the most popular additive names in the marketplace. The comparison formulations were selected based on consumer familiarity and market penetration of the brand names. There are many others that could have been included in the comparison, but space limitations prevail.

Of the thousands of diesel fuel additives out there, these are some of the more well-known selections in the market.

The logo for Sta-Bil, featuring the word "STA-BIL" in a large, bold, red, italicized sans-serif font with a registered trademark symbol.

**Sta-Bil 360® Performance™** (Gold Eagle) - Gold Eagle's Diesel Formula Sta-Bil® Fuel Stabilizer formulation is very well-known within the industry as a fuel stabilizer for diesel fuel. Gold Eagle also recently introduced a formulation to treat ethanol fuels. The Gold Eagle company was started in 1932 and has significant market presence in the automotive aftermarket arena. They have a broad range of products including HEET for gasoline, starter fluid, washer fluid deicer and octane improvers (technically not street-legal). For the purposes for this comparison, Ethanol Defense® will be compared with Gold Eagle's Sta-Bil 360® Performance fuel additive for ethanol.



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**Star Tron®** (Star brite) – Star brite (with a lower-case ‘b’) markets itself primarily as a marine product company. It was started in 1973 to promote one single product, an auto polish. In the 1980s, Star brite branched out into the marine sector, promoting boat polishes, waxes and appearance-care products. Today, Star brite also promotes oil, lubes and winterization products. For this comparison, Ethanol Defense® will be compared to the Star Tron® Small Engine enzyme fuel treatment for gasoline.



**Sea Foam®** (Sea Foam Sales Co.) – Sea Foam Sales Co. of Eden Prairie, MN, originally formulated Sea Foam in the 1930s as a product for the marine and outboard motor markets. Its original inventor was a District Manager for the Sinclair Refining Company. Though its product line has been dominated for most of its history by its multifunction motor treatment, today, Sea Foam has products for the auto, diesel, marine, powersports and small engine market sectors. For the purposes of this comparison, Ethanol Defense® will be compared to the Sea Foam® Motor Treatment fuel additive.



**Amsoil Quickshot®** (Amsoil Inc.) – Amsoil Inc., based in Superior, Wisconsin, cut its teeth in the lubrications business starting in 1972. Over the years, Amsoil has sold synthetic oil formulations primarily through a multi-level marketing business plan. Today, Amsoil’s diversified product line includes motor oils, grease, transmission fluid, compressor oils, filters and, more recently, fuel additives for gasoline and diesel. For the purposes of this comparison, Ethanol Defense® will be compared to the Amsoil Quickshot® fuel treatment.



**STP® Gas Treatment** (Armored AutoGroup®) – STP started in 1953 as a motor oil treatment created by the Chemical Compounds company in Missouri. STP originally stood for “Scientifically Treated Petroleum”. STP became, perhaps, most well-known in the 1970s for sponsoring race car drivers Richard Petty and Mario Andretti. Today, STP is part of the Armored AutoGroup® along with Prestone® and Simoniz®. For the purposes of this comparison, Ethanol Defense® will be compared to the STP® Gas Treatment product well-known by millions of consumers around the world.

## Comparative Infographic – Ethanol Defense® vs. The Marketplace




The infographic below summarizes the legitimate claims made by each additive in qualitative form. This is followed by a summary description of how each type of ethanol fuel additive performs in each desired trait. The goal is to provide a clearer picture of the effectiveness of each formulation vs. its product claims.



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## To treat ethanol-blended gasoline, Which additive is right for you?

There are lots of additives for ethanol fuel and they all claim to be the best. Here's how they compare.

ETHANOL TREATMENT		ETHANOL DEFENSE®	STAR TRON	SEA FOAM®	AMSOIL QUICKSHOT®	STP® GAS TREATMENT	STA-BIL 360° PERFORMANCE™
	More mileage and power	✓	✓	✓	✓		✓
	Prevents ethanol damage	✓			✓		✓
	Removes water without alcohol	✓				✓	✓
	Cleans injectors and deposits	✓	✓	✓	✓	✓	✓
	Prevents ethanol phase separation	✓	✓		✓		✓
	Backed by over 100 years of experience	✓					
	Low treat rate	✓	✓				✓
		1 oz per 10 gal	1 oz per 6 gal	2 oz per 1 gal	8 oz per 12 gal	12 oz per 28 gal	1 oz per 5 gal
	Low cost to treat	✓	✓				✓
	(cost to treat 20 gallons)	\$1.72	\$3.33	\$19.97	\$14.91	\$4.51	\$3.12

✓ = Good Choice For This

### The Choice Is Clear

**Ethanol Defense** from Bell Performance does more - for less - than any other ethanol fuel treatment. It's your best choice to prevent ethanol problems and enhance all your ethanol fuels.





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Now, let's examine how these ethanol fuel additives compare with respect to their specific benefit claims.

**Improves Mileage & Power** – Five out of the six formulations compared – Ethanol Defense®, Star Tron, Sea Foam®, Amsoil Quickshot®, Sta-Bil 360® Performance – show evidence of having a positive effect on fuel mileage.

STP® Gas Treatment does not contain any ingredients shown to have a beneficial effect on gas mileage.

<b>Improves/Claims To Improve Mileage &amp; Power</b>		
<b>Ethanol Defense®</b>	Contains a combination of multiple detergents and combustion improvers. Typical mileage improvement is about 6-9%, which is near the top of the industry.	
<b>Star Tron</b>	Claims fuel economy increase and carbon removal, indicating a possible combustion improvement and detergency effect.	
<b>Sea Foam®</b>	Cleans and dissolves deposits in fuel injectors, which can have a beneficial effect on fuel mileage.	
<b>Amsoil Quickshot®</b>	Contains detergents to clean injectors, resulting in improvement in fuel mileage.	
<b>Sta-Bil 306® Performance</b>	Contains injector detergents which can yield a mileage improvement.	
<b>Does Not Improve Mileage &amp; Power</b>		
<b>STP® Gas Treatment</b>	An analysis of its SDS indicates no ingredients shown to have a positive effect of mileage.	

**Cleans Injectors & Engine Deposits** – All six formulations claim to contain ingredients that dissolve engine deposits and/or injector deposits. Normally, this would also result in fuel mileage improvements. The exception in the group is STP, which contains solvents in its formulation which can dissolve some kind of injector deposits, but the formulation overall has not been shown to improve fuel mileage enough to sustain a marketing claim of such.

<b>Cleans Fuel Injectors &amp; Engine Deposits</b>		
<b>Ethanol Defense®</b>	Contains a package of multiple detergents for injectors (PFI), valves and combustion chambers, along with a non-alcoholic surfactant package to clean deposits in stored fuel.	
<b>Star Tron</b>	Provides satisfactory added detergency for injectors.	
<b>Sea Foam®</b>	Provides satisfactory added detergency for injectors.	



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<b>Amsoil Quickshot®</b>	Provides satisfactory added detergency for injectors.	
<b>Sta-Bil 306® Performance</b>	Provides satisfactory added detergency for injectors.	
<b>STP® Gas Treatment</b>	Provides satisfactory added detergency for injectors.	

**Controls/Removes Water** – Three formulas – Ethanol Defense®, STP® Gas Treatment and Sta-Bil 360® Performance – contain non-alcoholic water removal constituents.

The other three products – Star Tron, Sea Foam ® and Amsoil® Quickshot – do not contain water-removal ingredients that are non-alcoholic in nature. Star Tron and Sea Foam®, in particular, imply that they control water (hence, their suitability as ethanol treatments), yet water will not mix with their formulations in laboratory tests.

<b>Controls &amp; Removes Water</b>		
<b>Ethanol Defense®</b>	Contains both a non-alcoholic water absorber and a fluorosurfactant water controlling package based on Robert Bell’s surfactant technology first developed in 1927.	
<b>STP® Gas Treatment</b>	Contains a non-alcoholic water dispersant	
<b>Sta-Bil 360® Performance</b>	Contains a non-alcoholic water dispersant	
<b>Does Not Control Water</b>		
<b>Star Tron</b>	Does not contain any water-control ingredients. In fact, water cannot mix with the Star Tron formulation.	
<b>Sea Foam®</b>	Makes claims of suitability for marine use, yet water cannot mix with its formulation	
<b>Amsoil Quickshot®</b>	Does not contain a non-alcoholic water controller.	

**Prevents Ethanol Damage** – Ethanol Defense, Sta-Bil 360® and Amsoil Quickshot all contain ingredients that can be shown to slow or prevent ethanol damage in fuel systems.

Star Tron, Sea Foam and STP Gas Treatment do not contain any ingredients to prevent ethanol fuel damage.



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Prevents Ethanol Damage		
<b>Ethanol Defense®</b>	Formulated with a fuel-soluble protectant that provides boundary-layer protection against ethanol damage on polymer surfaces	
<b>Amsoil Quickshot®</b>	Claims to protect against “damaging corrosion”	
<b>Sta-Bil 360® Performance</b>	Contains a unique vapor ingredient that claims to provide protection against vapor corrosion above the fuel line in ethanol tanks and delivery systems.	
Does Not Prevent Ethanol Damage		
<b>Star Tron</b>	Does not contain ingredients to protect against ethanol solvency damage	
<b>Sea Foam</b>	Does not contain ingredients to protect against ethanol solvency damage	
<b>STP® Gas Treatment</b>	Does not contain ingredients to protect against ethanol solvency damage	

**Prevents Ethanol Phase Separation** – Ethanol Defense, Star Tron, Amsoil® and Sta-Bil 360® provide the essential benefit of improving the ethanol fuel’s ability to resist destructive phase separation. Sea Foam® and STP® Gas Treatment do not help in this critical regard.

Prevents Ethanol Phase Separation		
<b>Ethanol Defense®</b>	Formulated with water controllers to improve ethanol fuel’s ability to resist phase separation from water absorption	
<b>Star Tron</b>	Claims to retard phase separation, mostly likely due to the action of an alcohol-based water controller	
<b>Amsoil Quickshot®</b>	Disperses water in the fuel system and claims to prevent phase separation	
<b>Sta-Bil 360® Performance</b>	Prevents phase separation through the action of its non-alcoholic water controller	
Does Not Prevent Ethanol Phase Separation		
<b>Sea Foam®</b>	There is no evidence that Sea Foam has the ability to improve ethanol fuel’s ability to resist phase separation.	
<b>STP® Gas Treatment</b>	There is no evidence that STP® has the ability to improve ethanol fuel’s ability to resist phase separation.	





## Comparisons of Treat Rate Relative To Claimed Benefits

Treat rate ultimately determines the cost of use. If we examine typical retail pricing for these ethanol treatments, some stark cost-to-treat figures become apparent. Ethanol Defense® is the most economical treatment, costing \$1.72 per 20 gallons to treat. Star Tron and Sta-Bil 360® were two other ethanol additives that cost less than \$4.00 per 20 gallons to treat. Star Tron and Sea Foam® were, by far, the most expensive to use – Sea Foam® costs almost \$1.00 per gallon to treat, which normally would be prohibitively expensive for most parties.

To summarize the findings, we’ve listed all six formulations compared, their total number of benefits, and the claimed treat rates recommended to achieve those benefits.

Product	# of Benefits	Benefits Claimed	Treat Rate
<b>Ethanol Defense®</b>	7	Mileage improvement, Prevents ethanol damage, Removes water w/o alcohol, Cleans injectors, Prevents phase separation, Backed by 100 years experience, Low cost to treat	1 oz: 10 gallons (1:1280)
<b>Sta-Bil 360® Performance</b>	6	Mileage improvement, Prevents ethanol damage, Removes water w/o alcohol, Cleans injectors, Prevents phase separation, Low cost to treat	1 oz: 5 gallons (1:640)
<b>Star Tron</b>	4	Mileage improvement, Cleans injectors, Prevents phase separation, Low cost to treat	1 oz: 10 gallons (1:1280)
<b>Amsoil Quickshot®</b>	4	Mileage improvement, Prevents ethanol damage, Cleans injectors, Prevents phase separation	8 oz: 10 gallons (1:160)
<b>Sea Foam®</b>	2	Mileage improvement, Cleans Injectors	2 oz: 1 gallon (1:64)
<b>STP® Gas Treatment</b>	2	Removes water, Cleans injectors	1 oz: 2.3 gallons (1:300)

Armed with this information, there are some important observations we can make about each product.

**Ethanol Defense®** – Has the best combination of doing the most number of beneficial things (7) at a competitive treat rate of 1:1280, resulting in the lowest cost-to-treat.

**Sta-Bil 360® Performance** – Gives the second-highest number of benefits (6), but at a 2x higher treat rate than that of Ethanol Defense®. This makes it the second least-expensive ethanol additive to use.

**Star Tron** – Does four (4) important things, and at a competitive treat rate (1:1280) that makes it one of the lesser-expensive additives to use. Still does not do as much as Sta-Bil or Ethanol Defense®.

**Amsoil Quickshot®** – Does as many things (4) as Star Tron, but costs almost 4x as much to use.

**Sea Foam®** – Despite its reputation in the marine market, Sea Foam® gives very few benefits and is extremely expensive to use.



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**STP® Gas Treatment** – The most well-known fuel additive does the least number of things – only two clear benefits. Treat cost is reasonable at less than \$5.00 per 20 gallons. This, at least, puts STP® Gas Treatment ahead of Sea Foam in our value rankings.

## Conclusions

Consumers and businesses who decide they need an ethanol fuel treatment have choices. Many of these choices claim to do the same things. A careful examination should lead us to conclude the following (we listed our conclusions by product in the order of best to worst choice, by our assessment):

- **Sta-Bil 360® Performance** is a very good choice, probably the second-best choice of the additives surveyed. It does more things than almost any other additive, while being very cost-effective to use.
- **Star Tron** is a good combination of benefits imparted and low cost-to-treat. In our assessment, it is not as good as Sta-Bil 360 or Ethanol Defense® because it does not provide as many benefits. But it is clearly better than the additives later in this list.
- **Amsoil Quickshot®** causes a dilemma for the user. It provides four benefits, including the important benefit of preventing ethanol damage that Star Tron does not. But it is very expensive to use, so the consumer must weigh its high cost-to-use compared to other additives. It does not do as much as Sta-Bil 360 or Ethanol Defense®, both of which cost much less to use.
- **STP® Gas Treatment** only does a few beneficial things and would not be a recommended choice to treat ethanol fuels, as it fails to do several important things that a good ethanol additive should do. But its saving grace is that it does not cost a lot to use.
- **Sea Foam®** wins the dubious honor of being the worst ethanol additive in our list. It only provides two benefits, neither of which are uniquely required for ethanol fuels. And its high treat rate means it's the most expensive fuel additive to use – more than 6x the cost of Sta-Bil 360® or Star Tron and more than TEN TIMES as expensive as Ethanol Defense®. The consumer pays the most for the least benefit.

The final overall conclusion is that **Ethanol Defense® from Bell Performance is the best combination of value and cost for ethanol multifunction additives on the market today.** It does the most while costing the least to use of the reputable choices in this comparison. That is why we believe that Ethanol Defense® is your best ethanol fuel additive choice.