



STABILISERS

Understanding the Process

INTRODUCTION

Today most archers use a stabiliser/s in some configuration or another but most people have no idea of the purpose of stabilisers or how to select the stabiliser configuration best suited for their equipment.

Generally people simply follow the leader and purchase what everyone else is using never giving consideration to what is best suited for their equipment and technique and to the efforts stabilisers they choose will have on their shooting performance.

Many people are also fixated on purchasing trendy stabilisers that remove vibration and noise without realising that attempting to remove vibration and noise after the shot has no bearing on an archer's ability to hold the bow steady at full draw or contribute to the accuracy of the arrow.

This article details why stabilisers are used, some of the science involved with stabilisers and what the archers should be looking for when selecting and setting up a stabiliser.

It must be remembered the bow is a simple mechanical device and follows all the principals of engineering and physics.

Stabilisers used on modern equipment have three main functions –

- 1) Provide balance at full draw while maintaining the bows "Point of Balance" or "Centre of Mass", allowing the archer to hold the bow steady at full draw making aiming easy and consistent.
- 2) Reducing or delaying bow movement (torque or rotation) upon release until the arrow has left the string and passed the bow.
- 3) Removing or reducing vibration after the arrow has left the string and passed bow and the bow and string begins to react to the after effects of the shot.

Stabilisers and their effect can be divided into three areas, "Before the Shot", "During the Shot" and "After the Shot".

Before the shot

During the hold and aim process stabilisers are designed to help with balance and control over the bow.

This is an important element in the shot sequence, stabilisers provide balance ensuring the "Point of Balance" is maintained during the holding and aiming process making it easier for the archer to hold the bow steady, reducing movement at full draw making aiming quicker and easier.

The stabiliser's should be stiff enough so that the stabilisers resonant (resonance) frequency is well above the frequency of muscle tremors and bow movements otherwise the archer will develop a linkage between the stabiliser's vibrations and the archer's movements, and the archer 'will not be able to hold steady and aim'.

In simple terms if the stabilisers are very flexible as a result they will develop a high resonant frequency (vibrate at full draw) this will cause you muscles to tremor (shake) in sequence with the stabilizers at full draw. Alternatively due to poor bow set-up or poor fitness (strength) you muscles develop tremors (shake) causing the stabilizers to increase their resonant frequency (they vibrate even more) and this increased vibration will be transferred back into the body then the bow further increase shaking and movement.

During the Shot

During the shot is the most critical time, stabilisers are designed to keep the bow, arrow and string (nocking point) in the same plane maintaining the "Point of Balance" as at full draw and ensuring the arrow reaches brace height and leaves the string passing the bow handle without the arrow being moved out of line.

The biggest contributing factors affecting an arrow during the shot is the archer's technique, arrow clearance and most importantly bow hand placement, which creates rotation or torque upon release.

The rotation of the bow during the release is critical; the bows top limb will want to rotate away or toward the archer depending on bow design and bow/stabiliser set-up. This action is unavoidable but can be minimised with stabilisers set-up. Stabilisers should be used to encourage only slight forward rotation of the bow.

It should be noted that it takes between 15 and 20 milliseconds (this time depends upon draw length and the arrows physical weight) for an arrow to go from the full draw position to brace height where the arrow leaves the string and then passes the bow. This is an extremely short period of time but critical to accuracy and it is critical the bow remains in the same plane as at full draw as the arrow is shot and leaves the bow and any rotation is minimal and forward.

After the shot

After the arrow has left the string and passed the bow stabilisers no longer have any effect on the arrow or accuracy of the arrow, the main use of stabilisers after the shot is to remove shock and vibration. It should be stressed that vibration and noise has no effect on the arrow; this vibration happens way after the arrow has left the bow.

Some people feel it important to ensure the bow moves or rotates in the hand in a particular manner to ensure accuracy, the reality is that once the arrow has left the string and then passed the bow handle the stabilisers have no effect on the arrow what-so-ever and any such movement (after the arrow has left the bow) will have no effect on the accuracy of the arrow in any way.

When purchasing stabilisers many people focus on the reducing or removing vibration and/or noise believing if you remove this effect you will make the arrow more accurate, this could be no further from the truth.

Removing vibration and associated noise has become a major marketing exercise for many bow makers and accessory companies without any recognition to the fact that it has no relationship with accuracy or has any effect on the arrow which has now left the bow and on its way to the target.

When selecting a stabiliser set-up the principal focus should be on "Before the Shot" and "During the Shot". Controlling vibration and associated noise "After the Shot" should also be a consideration as it could lead to fatigue, loosing screws and possible damaging equipment but any consideration should be only to a minor extent.

WHAT ARE YOU LOOKING FOR?

Point of Balance or Centre of Mass

Ideally a bow should be set-up so the "Point of Balance" at full draw is just in front of the bow grip and just below the pivot point of the bow placing it just in front of the point the bow contacts the bow hand.

As you add accessories to the bow such as sight this will alter the "Point of Balance" of the bow, so stabilisers are used to set and maintain the "Point of Balance". So adding accessories or for the matter extra weight will change the "Point of Balance" and change how the bow shoots or in the case of recurve will have a significant effect on bow tuning.

It is particularly important that upon release, the bow, arrow and nocking point must be maintained in the same plane as at full draw until the arrow reaches brace height, leaves the string and passes the bow handle.

As previously mentioned it is also critical there is limited rotation of the bow around the pivot point until the arrow has passed by the bow.

Before the Shot

Before the shot stabiliser set up relates to balance, the archer wants to be able to hold the bow at full draw allowing the bow to sit comfortably in their hand and in particular with a recurve bow ensure the stabiliser and any weight added to the end of the long rod has not effect on the bows tiller. If you have too much weight on the front of a recurve bow gravity will pull on the stabiliser and the bow will pivot in you hand changing the bows tiller.

Also, the bow to tip should not move forward or backward when at full draw, as the archer will be fighting this when they are trying to aim.

A stabiliser set up should assist in keeping the bow vertical at full draw, hence the use of "V" bars for recurve and compound bows and bubble levels for compound bows. Any cant to the bow off the vertical at full draw will send the arrow off the target in the direction of the cant.

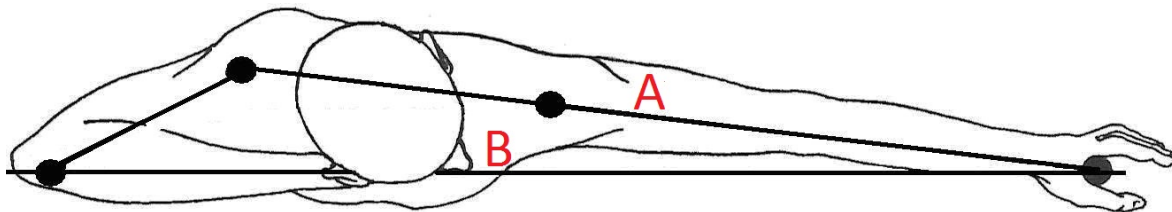
Care must be taken to ensure that too much weight is not added to the stabilisers, other than moving the "Point of Balance" low and forward, the archer has to be able to hold up the bow at full draw and excessive weight will cause fatigue and long term bow shoulder injuries. Excessive weight on the front stabiliser will force the bow to excessively rotate forward as the arrow moves out of the bow changing increasing rotation as the arrow is moving forward, effecting bow tuning and effecting accuracy.

During the Shot

As the bow is shot the natural reaction is for the bow to rotate in the hand (torque); for a right hand archer it will rotate toward the right, moving the bow tips to the left and causing a left shot. This rotation can be inconsistent if the force being placed on the bow handle varies from shot to shot.

The force placed on the bow by the bow hand and bow arm at full draw causes this rotation.

At full draw the force behind the arrow is in a line from the point the bow hand contacts the bow through the arrow to the fingers (or release device) holding the string and along the drawing arm to the elbow. But as we cannot shoot the arrow down our bow arm we are forced to apply side force to the bow at an angle that will cause torque (rotation) to the bow when shot.



In the diagram above - "A" is the line of force along the bow arm, which is at an angle to the line of the arrow, which is "B". This is why technique is critical, the greater the angle (gap) between shoulder and arrow the greater the torque forces being placed on the bow at full draw.

It is important that the archer develops a technique that has the bow shoulder pushed (not rotated) in as close to the arrow at full draw as possible without the string hitting the arm upon release. This will assist in reducing bow hand torque but you will never eliminate this torque all together, hence the main reason for the use of long stabilisers that will reduce or delay the rotation until the arrow has passed the bow.

Displacement

Displacement is very common during the holding/aiming process and just prior to release, it relates to being at full draw and the sharp quick movements of the bow from one place to another such as left to right with the most

common up and down. Technique, minute muscular tremors reacting to the load of the bow, general fitness and strength are all factors with this movement.

By adding stabilisers and increasing the physical weight of the bow can be used to assist in reducing or slowing these movements until the archer has sighted, released and the arrow has left the bow, but too much weight can increase these tremors.

Rotation

Rotation relates to the movement around an axis of the bow. The axis or pivot point is where the bow hand contacts the bow and the bow will rotate around this point. There are three rotational axes movements critical to archery.

- Forward and backward roll
- Side to side (rotational torque)
- Side to side roll

Backward and Forward Rotation

This relates to backward or forward movements of the bow around the pivot point (axis) of the bow. This can be caused by bow design, addition of accessories such as a sight, stabiliser weight and bow hand pressure.

This movement is controlled by ensuring correct technique in particular bow hand placement but also by adding weight in the form of long stabilisers or counter weights to the rear of the bow to ensure the "Point of Balance" is maintained.

Upon release there will also be unavoidable backward or forward "kick", this kick is unavoidable but can be reduced by using stabilisers, ideally any kick should be forward.

Side to Side Rotation (rotational torques)

This movement is possibly the most common rotation and the main reason why stabilisers are used. The bow is easy to rotate along its long axis as its long and narrow (particularly recurve bows). The archer's hand position and any side pressure exerted on the bow has a major effect on creating rotational torque upon release as the bow reacts to the side forces on the bow created by the bow arm and bow hand.

With compound bows there is the double issue of the bow arm and bow hand plus the side forces being exerted by the cable guard. If you are using a 50lb compound bow at full draw there will be 50lb plus of pressure pulling the cable guard in toward the arrow. The archer resists this movement at full draw by increasing the amount of pressure exerted by the bow arm and bow hand. As the archer releases and the force is taken off the cable guard the bow will want to react to this additional rotational torque.

The use of long stabilisers is designed to reduce or slow this rotational torque upon release.

Side-to-Side Roll

Side to side roll is the quick sharp side-to-side movement viewed by the archer around the pivot point when at full draw, holding and aiming.

The movement can be created by bow hand placement as well as minute muscular tremors to the load of the bow, also to the weight of accessories placed on the bow that create an imbalance. Shooting technique can be a major factor with correcting this effect or the use of V Bars or side counter weights can assist with reducing movement.

Vibration

When a bow is shot there is a large amount of the stored energy not transferred to the arrow, this energy remains in the bow and string and must be dissipated, this happens in the form of vibration.

This vibration does not happen until the arrow is well past the bow and on its way to the target and is a reaction to the strings forward movement.

When the string reaches brace height, the arrow leaves the string this is the last time the arrow has any contact with the bow as the front of the arrow should have left the arrow rest early on its forward movement.

When the string reaches brace height and the arrow leaves the string, the string continues to move forward in many case coming to within 60mm of the back of the bow. In line with Newton's third law "To every action there is an equal and opposite reaction" this is where vibrations commence as the string moves back to brace height and then backward and forward many times until it settles.

As the string moves backward and forward before it settles the stabilisers start to react and start to vibrate and any rubber shock absorbers start to move. This is also where all the sounds associated with the shot are created (unless the arrow has clearance problems and has struck part of the bow as it passes). It should be noted that this starts to happen some 25 to 30 milliseconds after the arrows has left the bow and is some 10 to 15 metres from the bow.

So there is no way these vibrations created after the arrow leaves the bow will have any effect on the arrow.

Stabilisers fitted with soft rubber attachments and similar attachments to the bow will help in removing or reducing vibrations and reducing the noise created following the shot.

The more rigid the stabiliser the greater effect, as rigid stabilisers vibrate at a lower frequencies and will absorb vibrations much easier.

It should be noted at this time that the use of soft flexible stabilisers should be avoided; these have a high resonant frequency and generally fail to absorb vibration in fact these flexible stabilisers can develop rhythmic vibrations at full draw, which can be transferred into the bow and archers body making it difficult to hold steady at full draw.

How Long a Stabiliser Should Be Used?

There is no rule to this but the longer the stabiliser the less weight needs to be added to the front of the stabiliser for the same effect, alternatively the shorter the stabiliser the more weight needs to be added.

It's a matter of experimenting to find the best length stabiliser for each person but generally the long front stabiliser should be around 28" to 32" in length.

How Much Weight Should Be Used?

The amount of weight that is added should be sufficient to provide the "Point of Balance" when at full draw and to ensure it is maintained during the shot.

Too much weight on the end of the long stabiliser can create excessive forward rotation when the bow is shot as well as making aiming difficult. Excess weight on the long stabiliser can change the tiller for recurve bows and can create nocking point movement for compound bows at full draw.

If you add additional weight to the long rod you then need to add weight to the rear of the bow to maintain the "Point of Balance".

It should also be considered that excessive weight could create fatigue problem and possible long-term injuries in particular to the bow shoulder.

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