



Mix it up
an dish it up

TOP
AGRAR
TEST

Each day, one of the five test machines had to feed 200 head of cattle and a 380kW biogas plant on the test farm.

Pictures: Höner

They are the all-rounders
in feeding cattle:

We tested five vertical diet
feeders for accuracy of
mixing and power
requirement.

Each year, the industry sells around 1,500 new diet feeders to German farmers, The top sellers being trailed, twin-auger models with a tub capacity of 16 m³. Feeders are expected to break up the material and produce a mostly homogeneous mix without squeezing the components. Ideally, the feeder pulls with ease to save fuel.

Vertical mixers with upright augers have become the most popular choice for many farmers - robust by design, they can handle baled silage and provide gentle treatment to the feed. This past spring, five feeders underwent a comprehensive test:

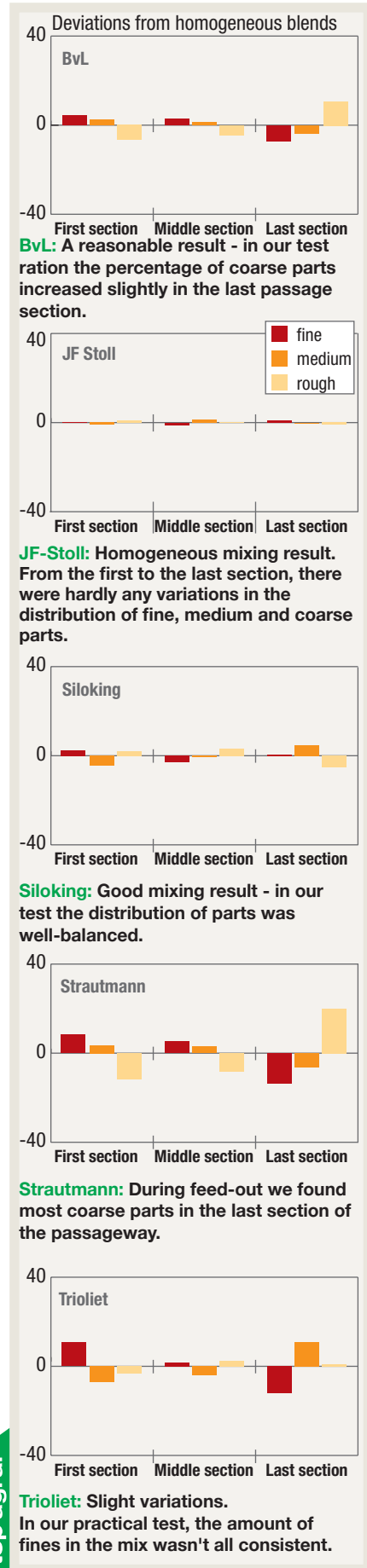
- BvL V-Mix 17N-2S plus
- JF-Stoll Feeder VM 16
- Siloking Duo Avant 16m³
- Strautmann Verti-Mix 1700 Double
- Trioliet Solomix 2-1600 VLL-B

We tried to get Kuhn to supply its new Profile feeder, but sadly the French company refused to take part in our comparison. All feeders came equipped with a two-step gearbox as well as an on-board weighing system. Over the duration of a whole week the machines were deployed to feed the dairy cattle, their offspring and also the farm's biogas plant, all

owned by farmer and contractor Frek Francksen from the community of Butjadingen in Germany. Each day was spent testing a different feeder. As in every test, we're putting our cards on the table - the manufacturers' product specialists were on site to attend their machines during the entire test. They knew about the feed composition and helped us set up their machines.

Bales are not a problem: The feeders' first challenge was to mix up some feed for the farm's young cattle. All feeders started out by breaking up a 1.25m third-cut silage bale. The chopped crop in the bale was rather dry and amassed to about 320kg. Each feeder was given two minutes for breaking up its bale. Then we topped up the ration to a total weight of 2t with second-cut grass silage

Table 1: Results from an on-farm mixing test



and subsequently with another 300kg of maize silage. Finally, the feeders had six minutes to finish up their cattle ration.

None of the feeders encountered any problems breaking up the round bales. JF-Stoll's model initially juggled the bale across its augers but finally got a grip and managed to break it up neatly. The Strautmann suffered a momentary seizure underneath its straw ring whereas the Siloking delivered best results mixing the bale silage uniformly into the feed.

It's all about mixing: Obviously our practical test also took into account the accuracy of mixing. The feeders had to mix up the feed components from the test farm and produce a mostly homogeneous mix for the dairy herd within a given time frame. Based on their experience, the manufacturers' specialists were free to decide on blade and counter-knife settings as well as auger speeds. Our only requirement was that all feeders mix in second (high) gear for ease of comparison.

The manufacturers also agreed upon a determined sequence for adding the individual feed components. Each day, the same driver filled the feeders in exactly the same manner. The test ration for the 120 head of cattle contained 80kg of straw, 100kg of concentrated pellets, 7kg of salt, 9kg of brewer's yeast, 14kg of mineral feed and 30kg of grain maize,

where the latter served only as an indicator in our feed samples. This is because the kernels are easy to spot in the samples, giving information about the distribution of the small components (such as concentrate pellets) within the ration. Please note that the distribution of finely-ground components such as mineral feed or brewer's yeast cannot be measured in the same way. These components tend to stick to the moist, coarse parts, displaying a distinct behaviour inside the feeder tub.

The straw and all the small components were treated to a minute's worth of mixing before we added 2,600kg of grass silage. At a DMC of 35%, the first-cut chopped grass silage had a rather high density of 286kg/m³. That meant some hard work for the feeders. After another minute of mixing, the ration was topped up with 2,300kg of maize silage with a DMC of 36%. Now each feeder was given six minutes to finish up the ration for the cows.

The samples for checking the accuracy of mix were taken directly from the passageway. All nine samples were gathered from a 2-metre-wide area either at the beginning of the 60m swath, halfway through the swath or at the end of the swath. These three sample points will be referred to as the first, middle and last swath sections. For the initial set of samples we tapped the feed stream, whereas the two back-up samples came directly from



During the inspection of the samples we were assisted by the farm's feed consultants.

the swath. All initial and back-up samples were between 250g and 400g per feeder.

Sampling in the shaker box: For our shaker box analysis, the Chamber of Agriculture in the German federal state of Lower Saxony provided us with an eccentric-drive electric shaker that ensured consistent test conditions for all feeders. Here our sample rations were broken down into fine, medium and coarse parts.

By taking samples from the first, middle and last sections of the passageway we obtained an overview of how accurately the feeders had managed to mix and discharge the feed. For an ideal mix, the percentage of fine, medium and coarse parts should be identical in all sections of the passageway. The consistency in the mixing performance from each feeder becomes apparent from the peak values in the bar graphs - the more balanced, the better the result (see overview 1).

JF-Stoll's feeder showed almost no variations across the graphs. As the top-scorer in this category it delivered almost identical feed mixtures in the first, second and third sections of the passageway. Siloking's Duo Avant was another great performer in this category. The Strautmann feeder had a tendency to discharge a higher amount of fines in the first section. Consequently, it delivered the longer bits in the last section - something we just noted, but no problem for the cows.

The BvL and JF-Stoll units achieved the best results incorporating the maize kernels which served as our countable small component. Both makes revealed the lowest variation values in this category. The feeders supplied by Siloking and Strautmann discharged a smaller amount of kernels in the first section of the passage. Accordingly, Siloking's Duo Avant delivered more kernels in the middle section, whereas Strautmann's Verti-Mix dropped the majority of kernels in the final section. Hence the slightly larger varia-

Farm machinery

tions in the test mixes produced by these two test candidates (see overview 2).

Uniform discharge: In the discharge category, feeders with a cross conveyor offer a slight advantage over other models. Their feed stream is easier to meter and the risk of running over the swath is lower. As the only feeder with no cross conveyor, van Lengerich proved that a simple slide is not necessarily a bad idea. Just like its competitors, it delivered a uniform, fluffy swath - all you have to do is drive a little closer to the feed fence.

After discharging with 540 pto rpm, all feeders had some feed left on the tub floor and on the augers. Trioliet was the machine with the least amount of material left in the tub. At 1,000 pto rpm all feeders emptied their tubs nearly completely, so that the amount of material left in the wagon was less than 10kg across all models.

49 to 74hp tractors: The interaction of tub shape, auger geometry and speed, the number and shape of the knives and counter knives not only affects the quality of the final mix but also the feeder's power requirement. After feeding the cows we moved our test machines over to our test farm's biogas plant, because we wanted to measure the tractor power needed to operate the individual feeders. Here we were able to produce four mixes per feeder in a day. Each ration was made up of 3,000kg of grass silage and 2,500kg of maize silage.

We used a torque-measuring hub to take four measurements of both the starting torque and the average power on a brimfull feeder - twice in low gear and twice in high gear. Since power equals torque times speed, we set the pto output speed on the tractor to

an exact 500rpm for all measurements.

Operating in high gear, as is common practice for most feeders, we discovered huge differences between the individual models (see overview 3). At 49hp, JF-Stoll's feeder has the lowest power requirement, with the Trioliet feeder following on its heels. In this category both machines benefit from their relatively small auger diameter. BvL and Strautmann are running level with more or less 63hp; it should, however, be noted that both have much larger auger diameters.

At 74hp, Siloking's feeder demanded the highest power from the tractor. While the augers are smaller in diameter than on the BvL, JF-Stoll and Strautmann models, they rotate at a higher speed and, in our test spec with three knives and an additional half-flight per auger, sported more aggressive cutting elements.

The easier it is to pull the feeder, obviously, the more fuel it will save throughout the year. Based on our calculation, the difference in fuel consumption between the two models with the highest and the lowest power requirement is 500 litres per year. This calculation assumes that a 120hp tractor will pull the fully-loaded feeder operating in high gear for 15 minutes every day. With the JF-Stoll feeder, the same tractor would use a mere 900 litres of diesel per year, whereas the Siloking would make it quaff a stunning 1,400 litres. This is put into perspective when you consider that a feeder which breaks up the feed more quickly will usually be operated for fewer hours per day.

Regardless of our measurements and of the brand, operators should never use more knives than necessary and only swing in the counter knives when needed. Don't forget to keep your knives sharpened!



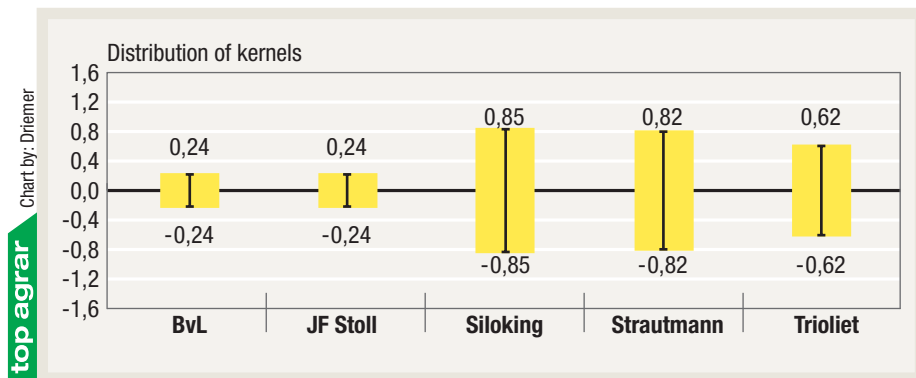
Grain maize served as the small component in the cattle feed ration.

Small tractor, low gear: All feeders in the test were equipped with a reduction gearbox, which offers the advantage of powering the feeder by a smaller tractor as well. With the gearbox in low gear, both auger speed and power requirement go down by roughly 33%. In return, the feeder takes more time to do the same job. In low gear, input differences among the feeders were notably smaller. Again, JF-Stoll topped the score sheet with a little over 35hp and even Siloking surprised us with a 43hp requirement in low gear.

Another important aspect is the feeders' starting torque (see overview 4). Starting torque is defined as the momentary mechanical resistance when engaging the pto, which at worst may cause the engine to stall. If you decide to completely fill the feeder before engaging the pto, you'll need a model with a low starting torque. In preparation for making the measurement each feeder travelled a set distance to make sure the feed would settle in the tub. The lowest starting torque of 1,170Nm was achieved by Trioliet. On the other end of the scale the Siloking feeder, with more than 2,000Nm (in high gear and with eight knives fitted), managed to stall the engine on our Fendt 716 tractor!

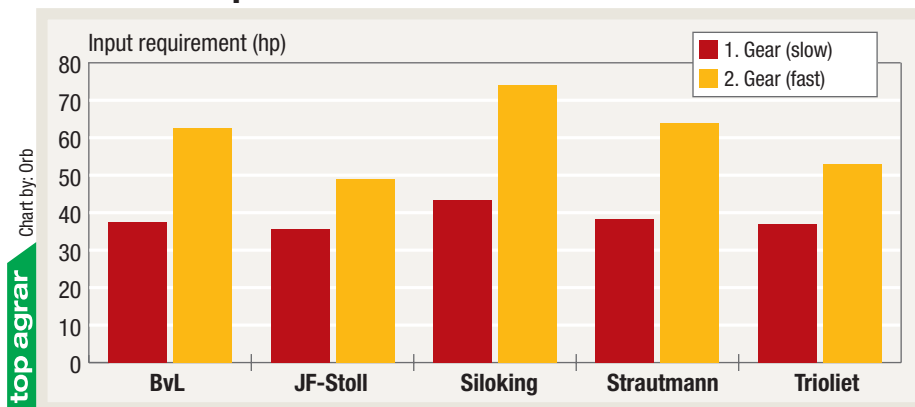
Reliable weighing systems: Obviously, you also want a reliable weighing system on your diet feeder. The more exact, the better! Almost all machines have four load cells

Table 2: Accuracy of blending in grain maize by diet feeder



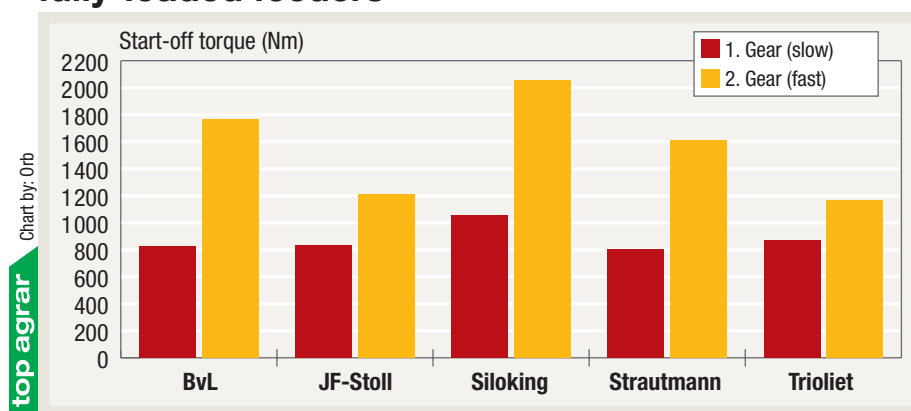
The kernel test: We counted the maize kernels contained in the feed samples that were taken from the first, middle and last sections of the test swath. The 0.0 line represents the average result obtained from all kernels found in a 500g sample. The length of the bars represents the variations in number of kernels by feeder when discharging the mix down the full length of the passage (standard deviation). On average, even the highest deviation values translate into only 0.85 kernels more or less per 500g of feed, so this should not be overrated in on-farm application.

Table 3: Average feeder power requirement from the tractor pto



The average power requirement for each fully-loaded feeder was measured twice per cycle within a four-minute time frame.

Table 4: Maximum starting torque on fully-loaded feeders



Before measuring the starting torque, all fully-loaded feeders travelled a specific distance to make sure the feed would settle in the tub.

tucked between the tub and the frame. Trioliet was the only participant to use three load cells, one of which is located in the feeder's drawbar. These load cells all have two strain gauges. Since one of the load cells on the Trioliet was incorrectly mounted, the test value deviated from our reference weight by a consistent 3.8%. After Trioliet fixed the issue, the deviation value was within tolerance - lower than 1%, as on all other feeders.

As standard, all weighing computers are mounted on a swivelling bracket above the drawbar. The numbers on all displays were large enough and easy to read. We loved the glare-free liquid crystal display on the Trioliet. For the test, JF-Stoll, Siloking and Strautmann presented their wireless weighing systems. Typically, these comprise a main terminal used to operate the feeder as well as one or more remote terminals for the loader. In this comparison, JF-Stoll's terminal had a longer reach than Siloking's unit. In the latter

case, the wireless connection is advertently cut at a certain distance to avoid operating errors on the feeder. Working with these systems was a real pleasure. The display on the loader is in the operator's comfortable line of sight. The system even issues audible alarms when the target weight has been reached.

Programming recipes: Another advantage of wireless weighing systems and computers is the feed programme which the user can create on the office computer and then send to the feeder via a wireless connection or a USB device. This also enables you to configure or edit your components, recipes and groups of animals before you start work. Furthermore, these programmes now offer various features for managing your feed stock or for exchanging messages with your adviser. Similar feed software is also offered by BvL, Strautmann and Trioliet.

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Different designs: Naturally, we also regarded the design and the build quality on each feeder. Our dedicated team consisted of a farm engineer, an agricultural master craftsman, a contractor and a mechanical engineer. All team members agreed on one point - the Siloking's high level of build quality certainly raises the bar. The Duo Avant sports a straightforward design and shows that being a feeder doesn't mean you can't be a looker.

BvL and Strautmann share second position with a solid build. On a sour note, the electro-hydraulic open-centre system on the BvL feeder was a bit of a pain. The convenient Perspex window in the BvL's tub, though, is a nice feature and gives a clear view of the mixing augers. Strautmann was the only brand to use two different drivelines for the mixing augers. On all other makes, the gearbox provides direct power to the rear auger.

Coming in third, JF-Stoll gives a bit of a hard-edged look. Its hydraulic hoses are fas-



Our test feeders also had to digest round silage bales.

tened to the drawbar using mere cable ties. In return, JF-Stoll offers a well-protected, easily accessible housing for its electro-hydraulic components and its wireless weigher.

The Trioliet, on the other hand, didn't get the biggest cheers from our build quality team. Its tub welds are not quite as neat as on the other participants, its lighting is rather sparse and its drawbar offers no support whatsoever for the hydraulic hoses. The Trioliet's discharge belt is mounted in a very low position. While this may allow an excellent view of the belt and the door, the feed is more inclined to build up in short passageways than when mounting the discharge belt in a higher position (available as an option).

Low maintenance: With around ten grease points which need attending every 50

Overview of measurements and feeder specifications

Manufacturer	BvL	JF-Stoll	Siloking	Strautmann	Trioliet
Model	V-Mix 17 N plus	VM 16-2 SB L	Duo Avant 16 m³	Verti Mix Double 1700	Solomix 2 1600 VLL-B
Tub capacity, m³	17	16	16	17	16
Dimensions (L W H), m	6.8 2.44 2.71	7.0 2.3 2.66	7.05 2.4 2.68	7.7 2.17 2.61	6.25 2.31 2.9
Kerb weight, kg	6,520	5,072	6,122	6,595	5,672
Tub wall height, m	1.76	1.73 (+ 19cm)	1.9	1.8	2.3
Tub wall thickness, mm	8	6	6	8	8 (floor edge, 12)
Tub wall material	St 52 (S355)	S650	St 52 (S355)	St 52 (S355)	St 37 (S235)
Floor plate thickness, mm	20	15	20	20	15
Floor plate material	St 52 (S355)	S500	St 52 (S355)	St 52 (S355)	St 52 (S355)
Mixing augers					
Diameter, m	2.13	1.86	1.8	2.11	1.72
Height, m	1.04	1.16	1.16	0.92	1.42
Material thickness, mm	15	12	15	15	15
No. of flights	2	2.25	2.5	2	3
Knives per auger	5	5	8	6	5
Speed in high gear (low gear), rpm	30 (16)	32 (21)	33 (17)	29 (22)	31 (24)
Gearbox reduction	1 : 1.8	1 : 1.5	1 : 1.9	1 : 1.3	1 : 1.3
Avg. power requirement (high gear), hp	62.5	49	74.1	63.9	52.9
Max. starting torque (high gear), Nm	1,762	1,212	2,054	1,612	1,167
Feed discharge	Slide	Conveyor belt	Conveyor belt	Conveyor belt	Conveyor belt
Belt width, cm	-	76	80	84	76
Discharge height, cm	92	68	67	75	47
Display figure size, mm	45	Wireless system	Wireless system	45	42
No. of load cells	4	4	4	4	3
Deviation from weighing accuracy, %	0.3	0.4	0.3	0.9	3.8 (one defunct load cell)
Tyres	445/45 R 19.5	205/65 R 17.5 (duals)	385/55 R 22.5	215/75 R 17.5 (duals)	385/65 R 22.5
Price for short/long spare knives, □	43.10	45.-/85.-	58.56	54.10/69.27	63.-/94.-
Base-spec price, □	31,350.-	35,730.-	35,770.-	39,755.-	36,850.-
Test-spec price, □	40,420.-	41,260.-	40,830.-	43,395.-	43,955.-

All prices are gross list prices as specified by the relevant manufacturers. Prices may vary depending on level of specification.



**A level playing field:
All feeders were filled by the same operator under identical conditions.**

to 100 hours (depending on brand), all feeders require low servicing effort. Courtesy of its two drivelines, Strautmann's feeder has a few nipples more to attend. Not all feeders have decals attached to their grease banks. To check the lubrication diagram you'll have to flip through the relevant operator manual.

The manuals provided by BvL and Strautmann scored best in our rating, while all brands boast easy oil-checking capabilities on their auger drives - large sight glasses with MIN and MAX markings.

When it comes to pricing, the difference between brands is relatively small. With base spec starting from €30,000, the most expensive feeder is €44,000 in full spec.

Jan-Martin Küper

At a glance

- All feeders produce good blends and didn't squeeze the feed.
- JF-Stoll and BvL produced the most homogeneous grain maize mixes. Other feeders didn't perform quite as well.
- JF-Stoll's and Trioliet's feeders were the lightest pulling machines. Siloking demanded the highest tractor power input.
- Wireless weighing systems significantly enhance comfort.
- Siloking offers excellent build quality.





JF-Stoll Feeder VM 16



Left: At first glance, JF-Stoll's design may appear a little plain ...

Top: ... but it ticks the boxes with some sophisticated technology and an outstanding wireless weighing system.

Danish and easy to pull

Not only did JF-Stoll's feeder score with the lowest power requirement among all test candidates, it also delivered very even mixes.

Handling & operation

We found only few gripes as to handling and operating the JF-feeder on a daily basis. The fact that the gear reduction lever is mounted on the gearbox is not even an aggravation, because we hardly ever used the gear reduction at all. On the standard version you'll have to swing in the counter knives by hand. As an option, you can order a hydraulic function for the gearshift and the counter knives.

Much more important, however, is the feeder's wireless weighing system which as is standard spec. on JF-Stoll and works really well. Its main display is mounted on the loader. Here – or on the office PC - you enter, save and name your rations. Operators can program up to 99 different recipes made up of 64 components each. The mobile handheld display has a re-chargeable battery and connects to the main display via a wireless link.

Mixing & feeding

During our test, JF-Stoll's feeder began by juggling the silage bale on top of its augers before it finally got a grip and broke up the bale within the two minutes. The tub walls are bent at the top to avoid spills even when the tub is filled beyond normal capacity.

Top scores go to the VM-Feeder's mixing quality. The composition of the mix hardly varied in the first, middle and end sections of the feed passage. Even small components were neatly blended in.

Although the augers have no additional discharge arm, the feed was quickly discharged in a uniform swath. The only niggle could be the view of the feed-out belt, which is slightly obstructed, but to make up the operator can keep a sharp eye on the slide.

Power requirement

The JF-Stoll feeder doesn't need much horsepower - in high gear the augers rotate at 32rpm, demanding no more than 49hp. This modest input requirement is also underlined by the starting torque as the feeder takes a mere 1,212Nm to get up and running, scoring the second-lowest result behind Trioliet. This explains why only 5% of JF-Stoll's diet feeders are sold with a reduction gearbox which reduces the auger speed to 21rpm. In low gear the feeder absorbs an average 35.5hp

at a starting torque of 834Nm.

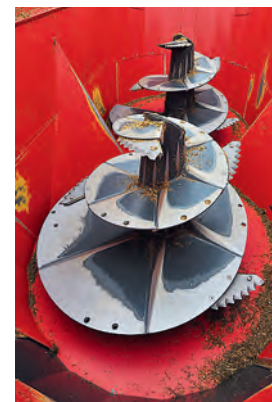
Design & build quality

JF-Stoll relies on a modular design, which provides for a base size tub with the option of adding specific extensions to gradually expand capacities on the 14m³ plus models. Tubs, floor plates and mixing augers are fine-grained steel. The front and rear walls are edged and the rim is slightly inclined to the inside to avoid spills. The axle is integrated in the frame. The discharge belt and the platform do not mount on the weighing cells.

Since the hand rail is too close to the operator, the platform can be cumbersome to enter. All electro-hydraulic components are grouped in a housing on the drawbar where they enjoy exemplary protection, whereas hose routing could do with being tidier. -jmk-

plus & minus

- + Lowest average power requirement among all feeders.
- + Good mixing quality during the test.
- + Excellent programmable wireless weighing system.
- Tub has no inspection window.
- Steep ladder, small platform.
- Average build quality.



The maker offers long and short auger knives. The long knives can be fitted in two different positions. JF-Stoll's auger does without a second discharge arm.