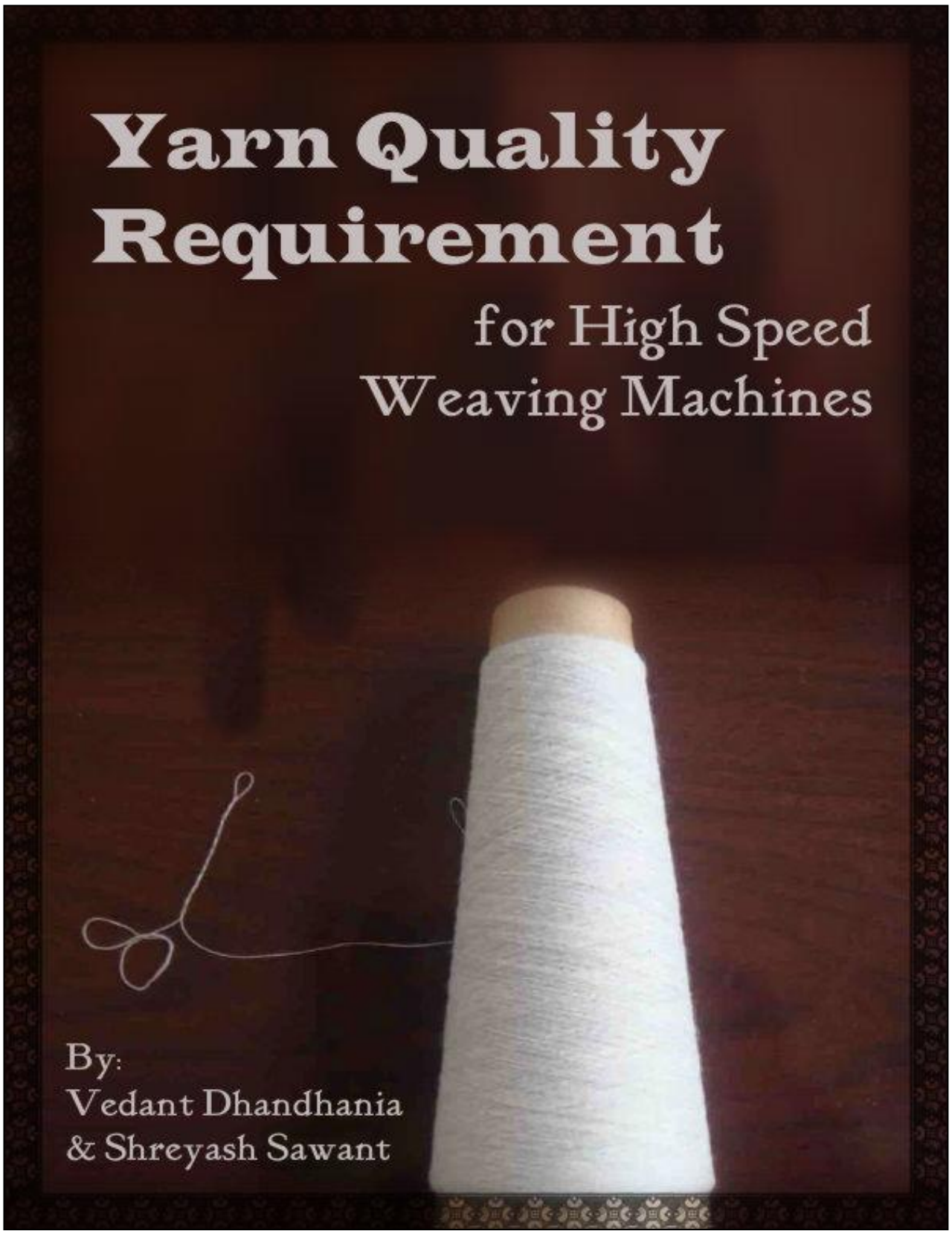
Yarn Quality Requirement
for High Speed Weaving Machines
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Tension on the warp on a high speed shuttle less weaving machine is higher than that on conventional loom. Normally shuttle less weaving machine works three to four times faster and if quality of warp remains the same, warp breaks will increase three to four times resulting in low production. Yarn should be more even and the following parameters of yarn are to be critically reviewed; C.V. of count, single thread strength, C.V. of single thread strength, imperfections per 1000 meters such as thick places, thin places and neps. Hairy yarn will not be suitable in air jet weaving as it will misdirect the weft insertion. On some Rapier looms, interference by rapiers, at the initial points of entry and terminal point of shed exit, can cause bending of the top yarn sheet around the rapier head producing excessive warp strain on the selvedge region of warp. Weft tension on Sulzer Ruti projectile weaving machine is equally high, where tucked-in selvedge is formed. Consistency of single end strength, C.V. of count and elongation is essential. Quality of yarn should be at least within 25% Uster which means the quality is among the best 25% of the mills in the world. But if we are running the loom at more than 500rpm with ends/inch of more than 100 then the mill should go for 5% Uster norms of yarn. Thus, the above discussion makes it clear we will be concentrating on the yarn quality required for its successful use in high speed weaving like air jet, rapier or Sulzer Ruti.

When it comes to high speed weaving, the yarn quality parameters have to be changed. Shuttleless looms weave 2 to 4 times as much as conventional looms per unit time. A plain power loom runs at around 180 rpm whereas a projectile Sulzer Ruti P7200 runs at around 430 rpm, a Dornier rigid rapier at 460 rpm and a Picanol Air jet runs at as high as 1100 rpm. Thus, for the yarn to withstand such high speeds, it is very important o use better quality yarn because of few reasons mentioned further. Tension on the warp on a high speed shuttle less air jet weaving as it will misdirect the weft insertion. On some Rapier looms, interference by rapiers, at the initial points of entry and terminal point of shed exit, can cause bending of the top yarn sheet around the rapier head producing excessive warp strain on the selvedge region of warp. Weft tension on Sulzer Ruti projectile weaving machine is equally high, where tucked-in selvedge is formed. Although Strain upon the warp threads is reduced due to smaller depth of shed, the other factors existing in shuttleless weaving make it necessary for yarn to follow certain standards of quality which are definitely higher than those for conventional looms. The yarn breakage is directly proportional to the speed of the machine for same quality of yarn being used. Therefore, it can be rightly said that if the same quality of yarn (one which is used in conventional loom) is used in shuttleless looms then the yarn breakage may also be 2-4 times. So, let us understand the requirements of quality of yarn for it to successfully be used in high speed weaving.

Required quality of yarn for high speed weaving

We will be enlisting the required quality of yarn for each parameter one by one. For any count the count Coefficient of variation (Count C.V.) should be less than 1.4%. The variation in Twist per Inch (TPI) should be less than 5%. The Uster Unevenness % (U %) should be less than 8 to 10% depending on count. For instance, for 20s count U% should be less than 8.6 and that for 40s should be less than 10.1%, the imperfection level depends on thick place, thin place and neps which should ideally not be more than 65-67/1000 meters for 42s count. The +200 Neps/1000 meter should be less than 50.

The tenacity of yarn in terms of RKM should be more than 16.5 and its CV% should be less than 7.5% elongation being more than 5.5%. The elongation CV% should be less than 8%. Hairiness should be less than 4-4.5% and hairiness standard deviation less than 1.5%. Objectionable classimat faults should be less than 1 per 100km and total classimat faults should be less than 150 for the same length. Also, shade variation should not be there under UV lamp.

Above mentioned is the in general quality parameters of yarn required for high speed weaving. To be more precise, we have distributed the required quality of yarn in 2 contexts- yarn above 40s count and that below 40s count as mentioned in the table below.

Sr.	Parameters	Up to 40s	Above 40s
1	CV% for Count	Upto 1.2	Upto 1.4
2	Warp and Weft CSP	3200	300
3	Single thread tenacity	20g/tex	20g/tex
4	CV% for single thread tenacity	Less than 7	Less than 7
5	Elongation at break (%)	Above 5.5	Above 6
6	CV% for elongation at break	Less than 7	Less than 7
7	CV% for TPI	Less than 5	Less than 5
8	Uster Evenness%	Less than 10	Less than 11
9	Yarn Hairs having length more than 3mm	3 per Meter	3 per meter
10	Yarn imperfection/ 1000m	Less than 50	Less than 70

To generalize the above values let me state that “if we are running the loom at more than 500 rpm and the ends per inch is as high as 100 then we should go for 5% Uster norms of yarn.”

Guidelines to achieve above quality in spinning

In order to reach above quality there are some guidelines and changes made in spinning department which has been listed as below.

Raw material quality requirements for high speed weaving:

Raw material should be selected properly. There is a direct relationship between certain quality characteristics of the fibre and those of the yarn. 70 to 80% of basic yarn quality

is decided by cotton. 2.5% span length should be more than 28mm. Span length affects yarn strength and yarn uniformity. End breakage rate also depends upon the fibre length. Longer the fibre, lower the end breakage rate, better the yarn quality. Average micronaire should be in the range of 3.8 to 4.3 for counts 24s to 40s (Ne). It can be 4.1 to 4.7 for counts coarser than 24s. If the micronaire is coarse, the number of fibres in the yarn cross section will be less. This always results in lower strength and lower elongation. But it is easy to process coarse micronaire fibres in blow room and cards. Nepping tendency is less for coarse micronaire fibres. On the contrary, spinnability (in both speed frame and ring frame) is not good with coarser micronaire fibres. U% is affected by micronaire. Coarser the micronaire, higher is the U%. Coarser the fibre, higher the end breakage rate in spinning. Uster Thin place (-30%) in the yarn vary depending upon the fibre micronaire. Lower the micronaire; lower the thin places vice versa. Strength of the fibre should be more than 23 grams/tex. Elongation of the fibre should be more than 6%. No of neps per gram should be less than 250. We should not mix two cottons with wide reflectance value (Rd value) and yellowness value (+b). Sticky cotton should not be used. If cotton is sticky, it is better to reduce the percentage of sticky cotton in the mixing. Low humidity and high temperature should be maintained in the departments. Cottons with less contamination should be used.

Blow Room setting required:

It is better to do a perfect preopening and reduce the beater speeds in fine opening. If required one more fine opener can be used with as low as beater speed, instead of using very high speed in only one fine opener. If the micronaire is lower than 3.8, it is not advisable to use machines like CVT4 or CVT3. Nep increase in cotton after blow room process should be less than 80 %.(i.e. 180 % of raw cotton nep). The difference in duct pressure should not be more than 40 pascals in chute feed system. Blow room feeding should be set in such a way that the draft in cards is same for all the cards and the variation in feed density is as low as possible fibre rupture in blow room should be less than 2.5%.

Carding setting required:

70% of the quality will be achieved in carding which depends on card wires. Flat tops with 400 to 500 points per square inch should be used. If the micronaire is lower than 3.5, the cylinder speed should be around 350rpm. If the micronaire is in between 3.5 to 4.0, it can be around 450 rpm. If the micronaire is more than 4.0, it can be around 500 rpm. Lower the micronaire, lower the licker in speed. It should range from 800 to 1150 rpm depending upon the micronaire and production rate pointed wires should be used for cylinder. Card autolevellers should be set properly. Nominal draft should be correct. Draft deviation should not be more than 5% during normal working. 10 meters C.V% of card sliver should be less than 2.0 and sliver weight difference between cards should not be more than 2.5%. Also, its U% should be less than 3.5. Trash in sliver should be less than 0.1 % and sliver hank should range in between 0.12 to 0.14 Ne.

Comber setting required:

In lap preparation, total draft, fibre parallelization, no of doublings, lap weight etc

should be decided properly (based on trial). Higher the lap weight (grams /meter) lower the quality. It depends upon the type of comber and the fibre micronaire. Setting between unicomb and top nipper should be same and it should be around 0.4mm to 0.5 mm. For cottons with micronaire up to 3.5, top comb should have 30 needles/cm and for cottons with more than 3.8 micronaire, the top comb should have 26 needles/cm. Variation in waste percentage between combers should be as low as possible (less than 1.5%).

Draw frame setting required:

Draw frame with a short term Autoleveller is a must. No of doubling should not be less than 7 and the total draft also should be more than 7. U% should be around 1.5 to 1.8. 1 meter C.V% (from Uster Evenness Testing machine) should be less than 0.6. A% should be less than 0.8. The delivery speed should be around 400 to 500 meters per minute depending upon the maker of the machine.

Speed frame setting required:

Total draft should be around 10 for 4 over 4 drafting system. Better to use floating condenser in the front zone to reduce hairiness. Break draft should be around 1.18 to 1.24 depending upon the type of drafting system and total draft. Roving hank should be decided in such a way that the ring frame draft is around 20 to 34 for different counts. Roving hank should be decided in such a way that the ring frame draft is around 20 to 34 for different counts.

Ring frame setting required:

Front zone setting should be as close as possible and break draft of 1.14 and back zone setting of 60 mm is recommended with 65 degree shore hardness for front top roller. Buffing should be carried out once in 45 days and if the top roller diameter is less by 1.5 mm from the standard diameter, top roller should be changed. The gap between front top roller and apron nip should be as low as possible (around 0.5 to 1 mm) as if it is more imperfections will be high. Bottom and top aprons should be changed at least once in 1.5 years. It is better to use lighter travelers instead of using heavier travelers. Enough trials should be taken, because traveler size depends upon, speed, micronaire, humidity condition, count, ring diameter etc. It is advisable to use Elliptical travelers for hosiery counts Ring travelers should be changed before 1.5% of travelers burn out and whenever there is a multiple break, ring travelers should be changed. At any point of time, fluff accumulation on travelers should be less. Ring traveler setting should be close enough to remove the waste accumulation but at the same time it should not disturb the traveler running. Hairiness variation between spindles should not be high and to achieve this, traveler should be changed in time, bad workings (multiple breaks) should be avoided, and rings like TITAN rings (from Breaker) should be used whereas damaged rings should be removed. Ring frame breaks should be as low as possible (less than 10 breaks per 1000 spindle hours) start up breaks after doffing should be less than 3 %. Overhead cleaners are a must for processing combed cotton. Exhaust trenches should be between machines and for every 200 spindles there should be a trench. Ring centering should be perfect. If ring diameter is more than 40 mm, ring centering plays a major role. If ring

centering is not done properly, hairiness variation within the chase will be very high. Good quality spindle tapes should be used and changed for every 24 months. Spindle speed variation will affect yarn strength, tpi and hairiness.

Winding setting required to produce high quality yarn suitable for high speed weaving machines:

All medium and fine counts and all blended yarns with polyester components should be wound on automatic winding machines like Autoconer, Murata, etc. In choosing optimum clearing settings, indiscriminate removal of thick places is not desirable since removal of each fault is replaced by another fault namely a knot. Knots act as sharp instruments on the adjacent threads, besides being responsible for peak tensions generated during weaving. Tail ends of knots come in the way of clear shed formation and can be a cause of multiple breaks. Hence, each thick place is to be assessed with respect to its length, and only objectionable faults may be removed. This is possible only with electronic yarn clearer in conjunction with Uster Classimat which classifies yarn faults into twenty one categories (reference length & C.S.) The size of the tai I ends of knots should be small. The knotter is to be selected based upon the yarn number. A spliced yarn gives good results. It would be desirable that a splicer is provided instead of a knotter on the winding machine to give good results and to get rid of all the disadvantages of knots. A large no. of automatic winding machines is equipped with knot / splice tester which ensures 90-95% prefect joints.

The winding machine plays a very important role in determining the final quality of yarn. On further analysis we came across the fact that following yarn clearing setting should be made on the winding machine in order to use it in the high speed weaving looms.

Yarn Clearing Setting in EYC	Up to 40s	Above 40s
N=Diameter limit for neps	7	7
DS=Diameter limit for short faults	2.2	2.6
LS=Limit for short fault length	2	1.6
DL=Diameter limit for long faults & double ends	1.3	1.4
LL=Limit for long fault length	25	25
-D=Limit of the diameter decrease for thin places	20 to 25	25
-L=Limit for thin place length	40 to 60	60 to 90
C=Wrong count	1.4	1.4

The clearer setting decides the clearing efficiency. The clearer is intended to remove A4+B4+C4+D4+C3+D3 and highly objectionable c1assimat faults. If we obtain a clearing efficiency of 95 % then it is considered to be good C.I. Tension on the yarn during winding should be about 10% of corresponding single yarn strength.

Concluding Remarks

It is very clear from the above article that high speed weaving required a better quality

of yarn due to few reasons mentioned. If these quality parameters are not met successfully, there is major chance of yarn breakages in weaving resulting in more loom stoppages and we know that every stoppage has got a potential chance of inserting a fault in the fabric. Changes have to be made right at the raw material stage for meeting the quality parameters required for high speed weaving or shuttle less weaving. We have mentioned the quality required for each parameter of yarn in our article. Also, we have given brief guidelines of changes to be made in spinning department to reach this quality level successfully.

Thus, yarn plays a very major role in high speed weaving as it is the quality of yarn which will decide the quality of output fabric and yarn has to be of a minimum required quality for its successful running on high speed weaving machine.

This article was originally published in the Textile Review magazine, February, 2013, published by Saket Projects Limited, Ahmedabad.