Blending Wool

for a uniform top which meets specification

Martin Prins
CSIRO

FIBRE BLENDING

Consists of selecting the right amounts of suitable wools to fulfil an order
&
then mixing them to give a uniform product.

Once the material has been selected it is a unit and should all be treated together.

The objective is to fulfil the order with minimum outlay

- Wool selection is a complex process best performed by experts
  - this is true despite the use of objective measurement
- Some wool is easy to obtain
- Some is less common
    - and despite only small quantities being required it may be a very difficult part of the blend to obtain

Wool requirements should be closely specified to fulfil the end product

- Use of wool which has been core sampled and grab sampled and tested provides an assurance that the consignment specification will be met.

- If possible order each consignment as a unit, fully specified, then process it through to top still as a unit.

The importance of blending

- The end product is a yarn which will be woven or knitted into fabric.
- This yarn may have as few as 40 fibres or maybe even less in the cross section.
- Each cross section of the yarn should ideally contain a proportional blend of the input stock
  – so blending needs to start early!

Selecting a blend

- When the yarn requirement is known,
  the mean fibre diameter and length requirements of the top necessary to produce a good quality yarn are known.

- By use of the prediction formulae such as TEAM it is possible to calculate the expected:
  - mean fibre length – *Hauteur (mm)*
  - coefficient of variation of length – *CVH (%)*
  - Romaine or Noil – *(%)*

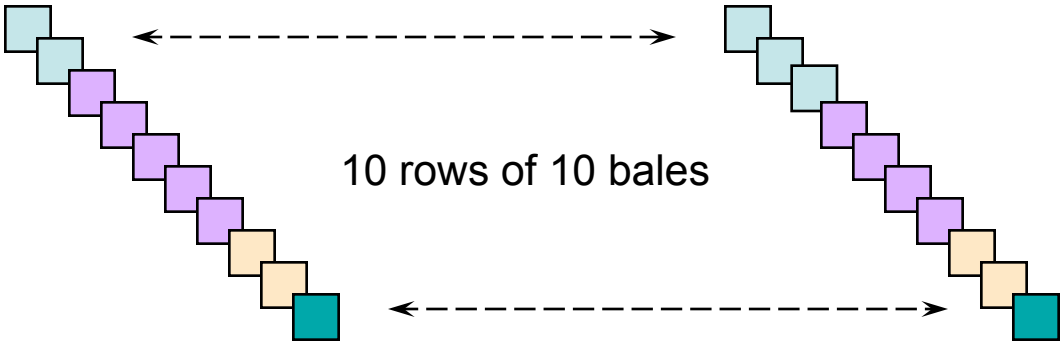
The TEAM-3 formulae

- Hauteur
  - *H = 0.43SL + 0.35SS + 1.38D - 0.45VM - 0.15MBC - 0.59CVD – 0.32CVL + 21.8*
- Coefficient of Variation of Hauteur
  - *CVH = 0.30SL - 0.37SS - 0.88D + 0.17MBC + 0.38CVL + 35.6*
- Romaine
  - *R = -0.13SL - 0.18SS - 0.63D + 0.78VM + 38.6*

SL = Staple Length
SS = Staple Strength
D = Diameter
VM = Vegetable Mater
MBC = Corrected mid breaks (if <45%, MBC = 45%; if >45%, MBC = actual value)
CVD = Coefficient of variation of fibre diameter
CVL = Coefficient of variation of staple length

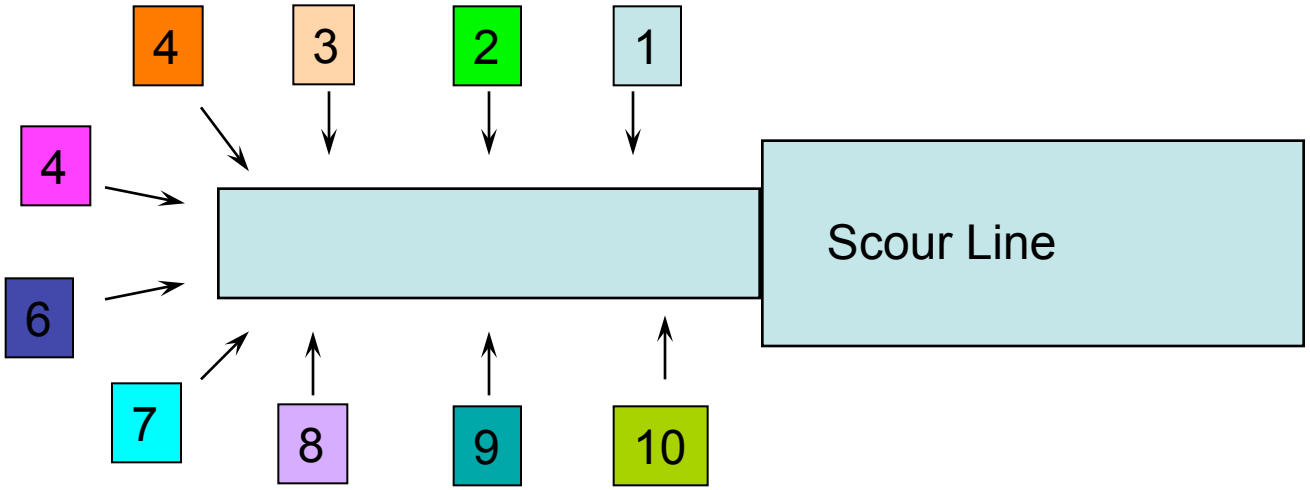
To mix the blend

- How many wool types are in the blend?
- How many bales of each type?
- Organise the bales in the warehouse so that each row of bales forms a representative blend.



At the scour

- One row of bales round the scour
- Do NOT sort the bales if specified
- If in doubt about meeting specification reject a full bale
- Take material from bales in sequence



At the scoured wool opener

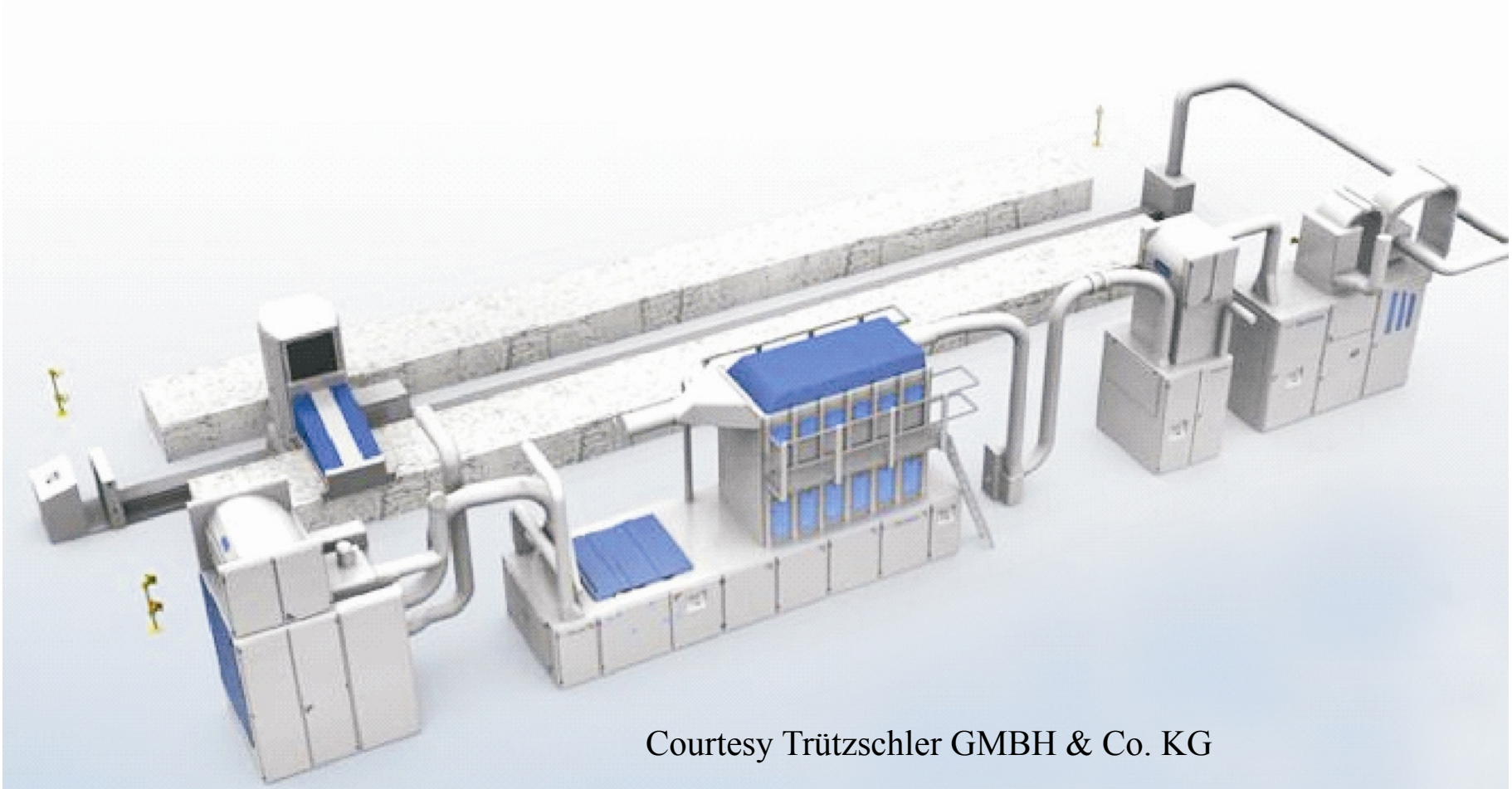
- By feeding material from the start, middle and end of the scour run, further blending will occur before entering the card.

During Topmaking

- Doublings
  - 1st Gill — 1 x 6 = 6
  - 2nd Gill — 6 x 6 = 36
  - 3rd Gill — 36 x 6 = 216
  - Comb — 216 x 24 = 5184
  - 1st Finisher — 5184 x 4 = 20736
  - Topmaker — 20736 x 6 = 124416

124416 doublings between card and top

Lay out of Blowroom



Courtesy Trützschler GMBH & Co. KG

An ‘engineered-in’ fibre selection should meet two main objectives.

1. A uniform profile of the characteristics of input fibres and corresponding end products

2. Maintain the average values of output characteristics at their desired levels

Ref.: El Mogahzy Y and Gowayed Y; Theory and Practice of Cotton Fibre Selection, Parts 1 & 2; TRJ 65(1) & 65(2), 1995

Economically, a proper fibre selection strategy should result in:

1. Better bale management
2. Improved cotton bale acquisition
3. Improved mill efficiency
4. Optimum cotton use

Ref.: El Mogahzy Y and Gowayed Y; Theory and Practice of Cotton Fibre Selection, Parts 1 & 2; TRJ 65(1) & 65(2), 1995

A fibre selection program should involve four basic steps:

1. Examine the population distributions of fibre properties of the bales
2. Implement reliable bale picking schemes based on the distributions of fibre properties of the bales
3. Control average output characteristics by developing reliable fibre-yarn relationships
4. Verify the effectiveness of the fibre selection program by monitoring the uniformity of fibre characteristics of bale laydowns and corresponding yarn characteristics

Ref.: El Mogahzy Y and Gowayed Y; Theory and Practice of Cotton Fibre Selection, Parts 1 & 2; TRJ 65(1) & 65(2), 1995

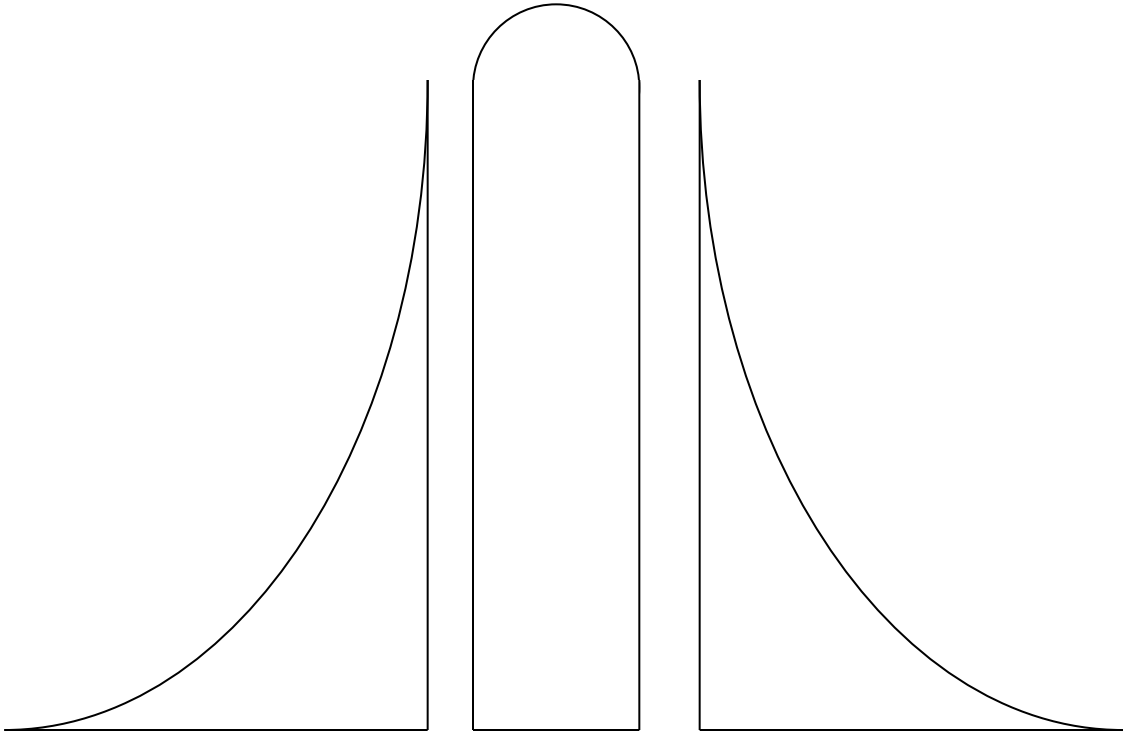
Bale picking schemes

1. Random picking scheme
2. Proportional weight category picking scheme
3. Optimum category picking scheme

Ref.: El Mogahzy Y and Gowayed Y; Theory and Practice of Cotton Fibre Selection, Parts 1 & 2; TRJ 65(1) & 65(2), 1995

FIBRE BLENDING CATEGORY EXAMPLE

Normal distribution of a fibre property, e.g. diameter



Category 1: Low

Category 2: Median

Category 3: High

The random picking scheme

1. An old approach of massive bale blending

2. Bales are picked randomly from the parent bale population

3. Any value of the fibre characteristic will have the same opportunity to be represented in the mix

Ref.: El Mogahzy Y and Gowayed Y; Theory and Practice of Cotton Fibre Selection, Parts 1 & 2; TRJ 65(1) & 65(2), 1995

The random picking scheme

1. If complete randomisation can be achieved this will result in ideal mixing

2. For large populations exhibiting high variability in fibre characteristics (typical for wool?), complete randomisation becomes extremely difficult

Ref.: El Mogahzy Y and Gowayed Y; Theory and Practice of Cotton Fibre Selection, Parts 1 & 2; TRJ 65(1) & 65(2), 1995

The proportional weight category picking scheme

1. Bales belonging to a certain category should be represented in the mix in numbers proportional to the relative frequency of their category in the population

2. Within a given category, bales should be picked at random

3. This scheme is suitable for populations that are normally distributed – large variations result in large between mix variability

Ref.: El Mogahzy Y and Gowayed Y; Theory and Practice of Cotton Fibre Selection, Parts 1 & 2; TRJ 65(1) & 65(2), 1995

The optimum category picking scheme

1. Recommended for distributions exhibiting large differences in category variances

2. Based on Lagrangian multiplier analysis - a method for finding the maxima and minima of a function of several variables subject to one or more constraints

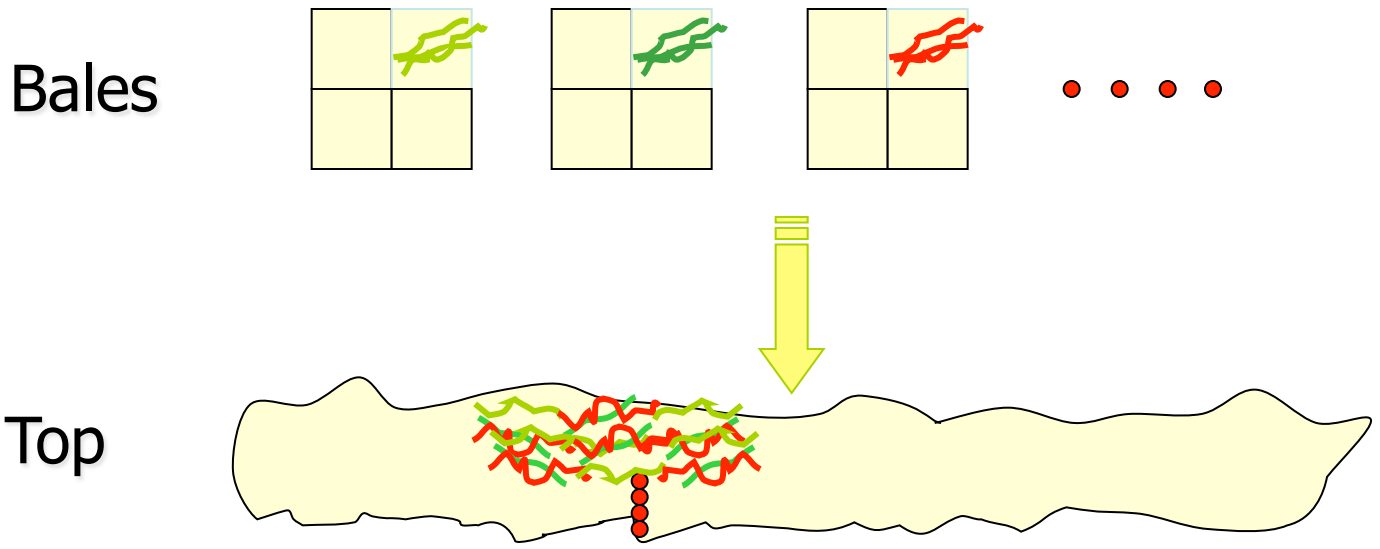
Ref.: El Mogahzy Y and Gowayed Y; Theory and Practice of Cotton Fibre Selection, Parts 1 & 2; TRJ 65(1) & 65(2), 1995

The optimum category picking scheme

3. The number of fibre properties within a category is selected with respect to cost of sampling a fibre property from each category (labour, energy), the within category variance and the total number of fibre properties in each category

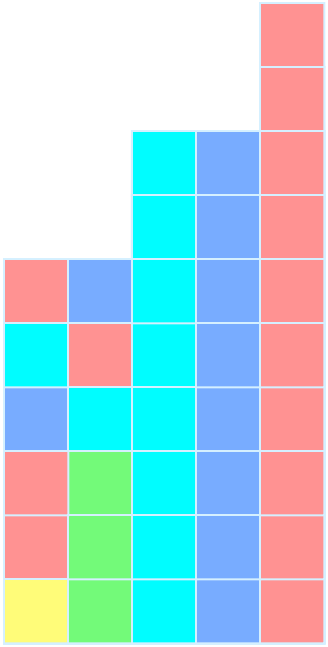
Ref.: El Mogahzy Y and Gowayed Y; Theory and Practice of Cotton Fibre Selection, Parts 1 & 2; TRJ 65(1) & 65(2), 1995

FIBRE BLENDING

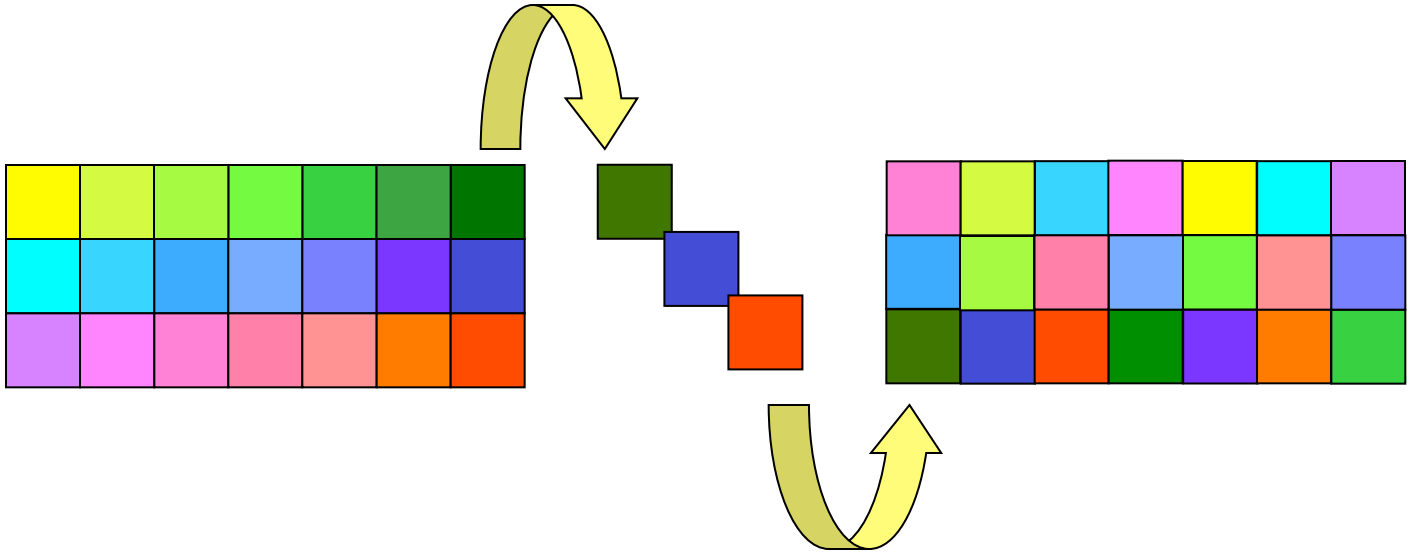


- Objective
  - every wool type in each m of top

Blending procedure for greasy wool



FIBRE BLENDING



Unblended wool

- **Horizontal layers**
- **Vertical cuts**

First stage blending

- **Horizontal deposition**
  - **Mixing of wool**
  - **Uniformity of blend**
- **Key condition**
  - **all wool together**

FIBRE BLENDING