Fibre and Yarn Science: A Fabric's Performance Begins in the Yarn

The handle, drape, strength, dye uptake and long-term behaviour of a knitted fabric are largely determined by fibre selection and spinning method, long before the fabric even reaches the knitting machine. This guide brings together natural, regenerated and synthetic fibres, yarn spinning techniques, numbering systems and sustainable yarn options from a B2B sourcing and product-development perspective.

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How much does yarn selection really determine a knitted fabric's performance?

> Yarn is the starting point of fabric performance. Fibre type, spinning method and yarn fineness directly affect handle, strength, pilling, dye uptake, shrinkage and drape. The knit structure shapes these properties but cannot conjure a quality the fibre does not provide. The right yarn is the precondition for the right fabric.

A common mistake in the textile supply chain is to attribute fabric behaviour solely to the knit construction (single jersey, interlock) or to the finishing process. Yet the final fabric in your hand begins, if thought of as a chain, with its lowest link: the **fibre**. Cotton's moisture management, polyester's elastic recovery, viscose's soft drape, modal's colour depth; these are all properties defined at the fibre level. The knit structure reveals or constrains this potential, but it cannot create a performance that is not present in the fibre.

The second determinant is how the fibre is converted into yarn. The same cotton fibre produces remarkably different surfaces and strengths when spun as combed, carded or open-end. The third layer is the yarn's fineness: the count, expressed in Ne or tex, governs the fabric's weight, cover and handle. Together, these three variables represent the most strategic decisions made during product development.

What is the fundamental difference between natural, regenerated and synthetic fibres?

> Natural fibres (cotton, wool, linen) are of plant or animal origin; regenerated fibres (viscose, modal, Tencel) are obtained by chemically reshaping natural cellulose; synthetic fibres (polyester, elastane) are polymerised from petroleum derivatives. Each family has a markedly different moisture, strength and care profile.

The fibre family defines the fabric's basic personality. **Natural fibres** stand out for breathability and moisture absorbency; cotton is the backbone of knitted fabric in this category. **Regenerated cellulosic fibres** are produced from wood pulp or cotton linter; although of natural origin, their production processes are chemical. This group offers a silky handle and a high hydrophilic behaviour. **Synthetic fibres**, by contrast, are superior in durability, dimensional stability and functional performance (stretch, wicking), but their moisture absorption is low.

In practice, most modern knitted fabrics are not a single fibre but a *blend*. Cotton-elastane provides stretch, cotton-modal delivers softness and colour depth, and polyester-cotton balances durability and cost. Blend ratios are designed according to the intended end use; this choice is often as decisive as the fibre type itself.

Fibre family	Example fibres	Strengths	Limitations
Natural (plant)	Cotton, linen	Moisture absorbent, breathable, skin friendly	Creasing, tendency to shrink when wet
Natural (animal)	Wool, silk	Thermal regulation, natural crimp	Care sensitivity, cost

Fibre family	Example fibres	Strengths	Limitations
Regenerated cellulosic	Viscose, modal, Tencel (lyocell)	Soft drape, vivid colour, hydrophilic	Wet strength (viscose), process-driven cost
Synthetic	Polyester, nylon, elastane	Durability, stretch, dimensional stability	Low moisture absorption, microfibre shedding

How do you choose between cotton, modal, viscose and Tencel?

> Cotton is a balanced and economical natural choice; viscose gives the softest and cheapest cellulosic drape but has low wet strength; modal offers higher strength and colour brilliance; Tencel (lyocell) is the strongest and most sustainable cellulosic option, produced in a closed-loop process. The decision is made according to handle, durability and sustainability priorities.

Although cellulosic fibres share the same chemical backbone, their production methods set their performance apart. **Viscose** is produced by the classic process and offers excellent drape; however, its strength drops markedly when wet, which affects post-wash dimensional behaviour. **Modal** is an improved derivative of viscose: it delivers higher wet strength and more vivid colour. **Lyocell** (known by the Tencel brand) is produced in a closed-loop process in which the solvent is recovered; it has the highest strength and the lowest environmental footprint among cellulosics.

Cotton is the reference point in this picture: widespread, processable, balanced. For a detailed comparison, see our cotton, modal, viscose and Tencel guide. The selection usually results not in a single fibre but in a blend constructed according to the target handle and price point.

Fibre	Handle / drape	Wet strength	Sustainability note
Cotton	Natural, full-bodied	Good (increases when wet)	Water/input intensive; organic and recovered options available
Viscose	Very soft, fluid	Low	Process chemicals; certified sources preferred
Modal	Silky, lustrous	Medium-high	Improved process compared with viscose
Tencel / lyocell	Smooth, cool	High	Closed loop, solvent recovery

How does the yarn spinning method change the fabric?

> The spinning method determines the yarn's surface and strength. Combing yields a clean, durable yarn by removing short fibres; carding skips this combing step and is bulkier and more economical; open-end is a yarn produced at high speed that is coarser and bulkier. Three different fabric characters arise from the same fibre.

Once the fibre is selected, the spinning process that converts it into yarn shapes its performance. Ring spinning produces the strongest and most even yarn by twisting the fibres; combed and carded are the two extremes of this family. Combing includes an additional combing step in which short fibres are removed; the result is a smoother, less hairy, less pilling yarn and a cleaner fabric surface. Carding skips this step; it is more economical and bulkier but has a hairier surface.

Open-end (rotor) spinning works on a different principle: it offers high production speed and gives a bulkier, more matte yarn; it is generally used in coarser counts and cost-focused products. You can find the practical effects of the three methods in detail in our combed, carded and open-end comparison. Advanced ring variations such as compact yarn reduce hairiness even further and are preferred for high-quality surfaces.

What do yarn counts (Ne, Nm, tex, denier) mean?

> Yarn count quantifies the fineness of the yarn. Ne and Nm are length-based systems: the higher the number, the finer the yarn. Tex and denier are weight-based: the higher the number, the coarser the yarn. Because count directly determines fabric weight and cover, it is the common language of the entire sourcing dialogue.

Yarn fineness is the most critical technical input in fabric design and is expressed through different numbering systems. In **direct** systems (tex, denier), the number gives the weight per unit length; the higher the number, the coarser the yarn. In **indirect** systems (Ne cotton count, Nm metric count), it gives the length per unit weight; the higher the number, the finer the yarn. This inverse logic is the primary source of sourcing errors when systems are confused.

In practice, a fine count (high Ne) produces fine, lightweight fabrics with low cover; a coarse count (low Ne) produces heavy, full-bodied fabrics with good cover. Because count directly determines weight, the target weight and yarn count must be designed together; for this relationship, see the weight/GSM guide. For inter-system conversion and practical examples, our yarn count guide offers a detailed reference.

System	Type	Logic	Common use
Ne (English cotton count)	Indirect (length)	Higher number → finer yarn	Cotton and cotton-blend knits
Nm (metric count)	Indirect (length)	Higher number → finer yarn	Wool, cellulosic, blends
tex	Direct (weight)	Higher number → coarser yarn	International standard unit
denier	Direct (weight)	Higher number → coarser yarn	Filament, synthetic yarns

What is the role of stretch and elastane yarn?

> Elastane (Lycra) is a synthetic fibre that gives the fabric stretch and recovery; it is generally used at a low proportion (typically a few per cent) together with the main yarn. It provides comfort, fit retention and form holding; however, it requires special control during dyeing and fixation processes. The proportion and feed method determine the fabric's stretch behaviour.

Much of modern knit comfort is thanks to elastane. Added at low proportions, elastane gives the fabric both stretch and recovery; this improves the garment's fit to the body and post-wear form retention. How the elastane is fed (bare, covered/wrapped) and how it enters the knit determine the direction and stability of the stretch. The dyeing and heat-set behaviour of elastane-containing fabrics differs from that of bare fabrics and requires careful process control; for details, see the elastane/Lycra knitting guide.

What are the sustainable yarn options?

> Sustainable yarns come via two main routes: recycled material (rPET from PET bottles, recovered cotton) and responsibly sourced natural/cellulosic fibres (organic cotton, certified lyocell). Most are now verified through chain-of-custody traceability and certification (GRS, RCS, OCS). The choice depends on the balance between environmental goals and performance.

Sustainability has now become a technical criterion in yarn selection. **Recycled polyester (rPET)** is produced from post-consumer PET bottles and offers performance similar to virgin polyester; it lowers the carbon and fossil-input footprint. **Recovered cotton** is obtained from production waste or textile waste; because the fibre length is shortened, it is generally blended with virgin fibre. **Organic cotton** and **certified lyocell**, meanwhile, reduce environmental impact through responsible farming and closed-loop production.

The commercial value of these claims depends on their verifiability. Chain-of-custody certifications such as GRS, RCS and OCS document the recycled content and content claims; the certifications held by KARCEM support this traceability. It is also worth remembering that sustainable yarn selection is increasingly becoming mandatory through regulations such as the ESPR and the Digital Product Passport coming into force in the EU. For technical details, see the recycled yarn guide.

How does the fibre and yarn decision connect to the sourcing process?

> The yarn decision affects the entire chain, from lab-dip approval, dye recipe and fastness performance through to the final four-point quality control. The right fibre/yarn selection reduces rework and deviation at every subsequent stage. That is why yarn is a decision that should be finalised at the start of product development.

Yarn selection is not an isolated decision; it propagates through the entire production and quality chain. The fibre type determines the dye class: cotton and cellulosics are dyed with reactive dyeing, polyester with disperse dyeing; blends may require two baths. This affects both the cost and the path to reaching the colour fastness and $\Delta E<1$ target. Yarn evenness and spinning quality predetermine the outcome of pilling and dimensional stability tests.

In a vertically integrated facility, this connection turns into an advantage: when yarn properties, knitting, dyeing/printing and finishing processes are coordinated under one roof, points of deviation are caught early. The advantage of an integrated facility ensures that the fibre/yarn decision is fully reflected in fabric performance. For the bigger picture, you can also review the knitted fabric guide and the fabric families.

> **With KARCEM:** Let us finalise the choice of fibre, yarn count and spinning method together according to your target handle, weight and sustainability criteria; we will evaluate suitable blend and certified yarn alternatives and make a concrete start with a sample or quotation request.