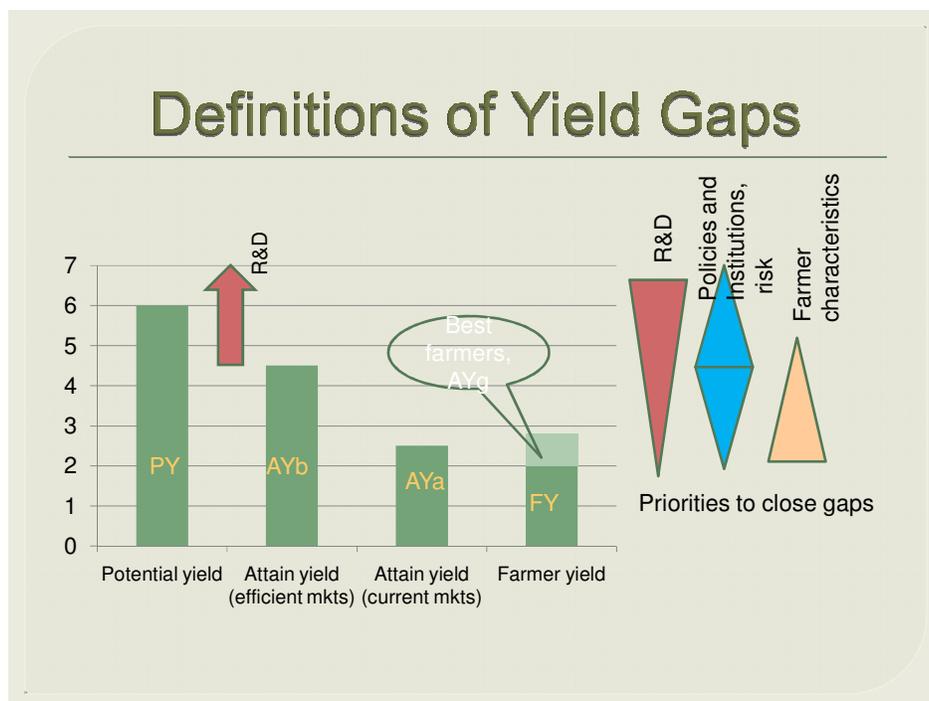


2.1 Yields and yield gaps

There are a number of measures of crop yields, which here means weight of grain harvested per unit field area at a standard moisture content (Table 2.1). The starting point is average farm yield (FY), from which we work upwards to attainable yield (AY) and then potential yield (PY). We include water-limited potential yield (PYw) because it is a sensible yardstick where crops receive on average only low to moderate water supplies (say < 75 percent of potential evapotranspiration). For increasing FY, the objective of this paper, both increasing PY (or PYw), and closing the yield gap, are important, and somewhat different interventions operate on these two steps. The overall gap PY to FY is considered in some detail because it is often easier to measure, but the key gap, the economically recoverable yield gap under current economics, is less, being $AYa - FY$ (Figure 2.1; Table 2.1). Another gap $AYb - AYa$ is the attainable yield gap under efficient institutions and markets (AYb), ultimately linked to world prices, less the AYa : this gap is often positive but can be negative where prices are subsidized to help farmers. Note that throughout this paper yield gaps are expressed as a percent of FY, for better comparability with the basis on which demand growth is estimated.

Figure 2.1: Schematic view of interesting yield gaps and ways to close them



Progress in potential yields, PY (or PYw the water limited potential yield), through genetic and agronomic research is an important source of yield growth because raising the yield frontier lifts other yields as well—a rising tide that lifts all boats. There is considerable evidence presented in Section 4 of this paper that $\Delta FY/FY \approx \Delta PY/PY$. However, much will also depend on interactions between genotype and management (Fischer, 2009). Generally PY progress has exploited positive interactions between the genetic and agronomic routes for improvement in yield. The increase in yields of semidwarf wheat and rice varieties at higher levels of management is, for example, significantly more than that of the tall varieties they replaced. In advanced systems however yield increase from agronomy alone, and from these positive interactions, appears to be slowing, although the ongoing synergy between increase maize yield potential and plant population is one exception (Evans and Fischer, 1999).