In this paper, we introduce a mean–variance criterion for production optimization of oil reservoirs and suggest the Sharpe ratio as a systematic procedure to optimally trade-off risk and return. We demonstrate by open-loop simulations of a two-phase synthetic oil field that the mean–variance criterion is able to mitigate the significant inherent geological uncertainties better than the alternative certainty equivalence and robust optimization strategies that have been suggested for production optimization. In production optimization, the optimal water injection profiles and the production borehole pressures are computed by solution of an optimal control problem that maximizes a financial measure such as the Net Present Value (NPV). The NPV is a stochastic variable as the reservoir parameters, such as the permeability field, are stochastic. In certainty equivalence optimization, the mean value of the permeability field is used in the maximization of the NPV of the reservoir over its lifetime. This approach neglects the significant uncertainty in the NPV. Robust optimization maximizes the expected NPV over an ensemble of permeability fields to overcome this shortcoming of certainty equivalence optimization. Robust optimization reduces the risk compared to certainty equivalence optimization because it considers an ensemble of permeability fields instead of just the mean permeability field. This is an indirect mechanism for risk mitigation as the risk does not enter the objective function directly. In the mean–variance bi-criterion objective function risk appears directly, it also considers an ensemble of reservoir models, and has robust optimization as a special extreme case. The mean–variance objective is common for portfolio optimization problems in finance. The Markowitz portfolio optimization problem is the original and simplest example of a mean–variance criterion for mitigating risk. Risk is mitigated in oil production by including both the expected NPV (mean of NPV) and the risk (variance of NPV) for the ensemble of possible reservoir models. The Sharpe ratio can be used to compute the optimal water injection and production borehole pressure trajectories that give the optimal return–risk ratio. By simulation, we investigate and compare the performance of production optimization by mean–variance optimization, robust optimization, certainty equivalence optimization, and the reactive strategy. The optimization strategies are simulated in open-loop without feedback while the reactive strategy is based on feedback. The simulations demonstrate that certainty equivalence optimization and robust optimization are risky strategies. At the same computational effort as robust optimization, mean–variance optimization is able to reduce risk significantly at the cost of slightly smaller return. In this way, mean–variance optimization is a powerful tool for risk management and uncertainty mitigation in production optimization.